PB-217 812

A COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM FOR THE LOWER PORTION UPPER MISSISSIPPI RIVER BASIN DEVELOPED BY THE STATE WATER POLLUTION CONTROL AGENCIES OF IOWA, MINNESOTA, AND WISCONSIN

Public Health Service
Cincinnati, Ohio

1955

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

FS 2.64:
71
64: 71

Water Pollution Series No. 71

PB 217 812 11011

A COMPREHENSIVE PROGRAM FOR WATER POLLUTION CONTROL

for the

LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

76

A COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM

for the

LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

Developed by the State Water Pollution Control Agencies

of

IOWA, MINNESOTA, and WISCONSIN

1955

Adopted by
U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

I

Public Health Service Publication No. 450

FOREWORD

Our country's development over the past 50 years has been marked by tremendous progress in many fields. It has made possible great gains in the health, comfort, and well-being of the people. But it has not been without cost. Part of the cost has been the damage to the Nation's water resources that has resulted from wastes discharged to the streams by our growing cities and industries. All water uses have been affected—public water supplies, recreation, agriculture, industry, fish and aquatic life.

In enacting the Federal Water Pollution Control Act in 1948, the Congress declared that "water pollution has become a matter of grave concern in many areas and its damaging effects on the public health and national resources are a matter of definite Federal concern as a menace to national welfare. Abatement must be undertaken in order to control it."

The Public Health Service, as part of its responsibilities under this Act, is required to prepare or adopt, in cooperation with other Federal agencies, State and interstate water pollution control agencies, municipalities and industries, comprehensive programs for the abatement of pollution.

This report contains the comprehensive water pollution control program for the Lower Portion Upper Mississippi River Basin of the Iowa State Department of Health, the Minnesota Water Pollution Control Commission, and the Wisconsin Committee on Water Pollution. The program is sound and gives full consideration to the several present uses and to the reasonably-anticipated future uses of the waters of this basin. It provides an equitable balance in the pollution control requirements for various private and public groups concerned.

I am pleased, therefore, in my capacity as Surgeon General of the Public Health Service, to adopt the program developed by the State water pollution control agencies of Iowa, Minnesota, and Wisconsin for the Lower Portion Upper Mississippi River Basin as a comprehensive program which fully meets the requirements of the Federal Water Pollution Control Act.

This program is based on beneficial water uses and related conditions that prevailed on November 1, 1954. Comprehensive programs for pollution control must necessarily be flexible. They must allow for growth, development and changing conditions. Any significant changes affecting water quality, such as stream flow, water use, industrial development, population, etc., may require changes in the pollution control program.

Obviously the mere adoption of this program will not, in itself, reduce pollution or improve the usefulness of the waters of this basin. It does provide to the citizens of the area and to the city officials and industrial leaders, farmers, fishermen, conservationists, and others an objective plan based on good engineering practice and reflecting sound economics. It is a plan which the public can support, and must support, if progress is to be made in the abatement of pollution.

Certain additional considerations beyond the mere acceptance of a plan are essential to its successful execution. The citizens of the areas affected must see that sufficient resources are provided to the State water pollution control agencies concerned to enable them to make the technical investigations to aid those responsible for constructing pollution abatement works.

We must recognize, too, that in order to be fully effective, the plans and programs of one State must be geared closely to those of adjoining States, since State boundaries are no barrier to pollution traveling in interstate streams. Above all, no program of this nature can progress beyond the report stage if its meaning and purpose are not made clear and understandable to the citizens of the area. In the final analysis, they are the ones who will pay, directly or indirectly, for the pollution abatement works that are needed.

It is my hope that this program for the Lower Portion Upper Mississippi River Basin will be carried through to completion so that the area may enjoy all the benefits that clean water can provide, in health and recreational opportunities for the people, and in sound growth of industry and agriculture.

Leonard A. Scheele
Surgeon General

TABLE OF CONTENTS

Page No.

Foreword- i

Introduction- 1

Part I

Comprehensive Water Pollution Control Program - - - - - - - - - - - - - - - - 3

Part II

Physical Description- 14

Economic Development- 16

Uses of Water Resources - 17

Pollution Discharged to Surface Waters- 19

Damages to Water Resources from Pollution - - - - - - - - - - - - - - - - - - 21

Benefits Resulting from Pollution Abatement and Prevention- - - - - - - - - - 23

Pollution Prevention Measures in Effect - - - - - - - - - - - - - - - - - - - 25

Pollution Prevention Measures Required- 30

Maps

Facing Page

Map No. 1—Existing Primary Water Uses- 17

Map No. 2—Sources of Municipal and Industrial Pollution and Existing Treatment Facilities - 19

Map No. 3—Municipal and Industrial Pollution Abatement Needs - - - - - - - - 30

Tables

Page No.

Table A—Sewered Municipalities - 19

Table B—Separate Industrial Outlets- 20

Table C—Existing Municipal Treatment Facilities- - - - - - - - - - - - - - - 25

Table D—Existing Industrial Treatment Facilities - - - - - - - - - - - - - - 25

Table E—Adequacy of Existing Treatment Facilities- - - - - - - - - - - - - - 26

Table F—Progress in Pollution Abatement- - - - - - - - - - - - - - - - - - - 26

Table G—Requirements for Municipal and Industrial Waste Treatment Plants - - 31

Table H—Status of Treatment Works Projects to Abate Pollution, November 1, 1954- - - - - 32

Appendix

Appendix I—Basic Data on Sources of Municipal Pollution- - - - - - - - - - - 34

Appendix II—Basic Data on Sources of Industrial Pollution- - - - - - - - - - 43

INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies, and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

This report, prepared in cooperation with the water pollution control agencies of Iowa, Minnesota, and Wisconsin, sets forth the water pollution control program being followed by the respective States in the Lower Portion Upper Mississippi River Basin. The program, which is based on data available as of November 1, 1954, was developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and lakes, and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Agencies which cooperated in the preparation of this report include the Iowa State Department of Health, the Minnesota Water Pollution Control Commission, and the Wisconsin Committee on Water Pollution. Likewise, acknowledgment is made to the Corps of Engineers, Department of the Army; Soil Conservation Service and Forest Service, Department of Agriculture; Bureau of Census, Department of Commerce; Bureau of Mines, Fish and Wildlife Service, and Geological Survey, Department of the Interior; and the Federal Power Commission for their review of the report and for the information gleaned from their published reports.

Part I

COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM for the LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

General Characteristics and Economic Development

The Lower Portion Upper Mississippi River Basin, as considered in this document, includes the drainage area of the Mississippi River from the northern edge of Minneapolis, Minnesota, to McGregor, Iowa, and the drainage areas of the tributaries entering between these points except those of the Minnesota and St. Croix Rivers which have been considered in separate reports. The land area within the basin is approximately 23,000 square miles with 64 percent in Wisconsin, 30 percent in Minnesota, and the balance in Iowa. The principal tributaries are the Chippewa, Cannon, Zumbro, Root, Trempealeau, Black, LaCrosse, and Upper Iowa Rivers.

The topography of the basin is gently rolling to hilly, with elevations reaching 1,600 feet above sea level in the northern area. The numerous lakes and swamps and the remaining forests in the northern area prevent rapid run-off and maintain a uniform flow in the streams. A significant characteristic of the streams, from a pollutional standpoint, is the prolonged ice cover during the winter when there is little opportunity to replenish dissolved oxygen by reaeration.

The climate of the basin is continental with only slight variations between the northern highlands and the central lowlands. The average annual precipitation varies from 27 to 32 inches with about 20 inches as rainfall during the 160-day growing season. January temperatures average about 14°F., and those for July are approximately 72°F. Temperature extremes range from -40°F. to 110°F. Snowfall varies considerably between the northern and southern portions of the basin with an average annual snowfall of about 40 inches.

Agriculture is the outstanding activity in the basin with most of the area in Iowa and Minnesota and three-fourths of that in Wisconsin under cultivation or in grassland. Timber farming is becoming an important occupation in the second-growth forest area of Wisconsin. The processing of farm and forest products is the outstanding industrial development in this basin, but printing and publishing, chemical manufacturing, machinery and metal fabrication, and the production of stone, clay, and glass products are also of economic importance.

Of major significance is the recreational industry since the watershed lies in a region that is nationally recognized as a vacationland. The numerous lakes and streams, with their excellent fishing and hunting areas and their inviting boating and bathing facilities, have attracted many thousands to this area annually. The resulting tourist business, together with associated enterprises, has become an important source of income for the area. Commercial fishing in the Mississippi River is also of economic significance as indicated by the 1952 commercial fish catch of over 2,880,000 pounds from Mississippi River Pools 1-9.

The basin had a total 1950 population of about 1,800,000 people, with 72 percent living in Minnesota, 25 percent in Wisconsin, and 3 percent in Iowa. The population of the basin increased more than 11 percent in the 1940-50 census decade, the larger cities being responsible for most of the increase. There are 14 cities with populations in excess of 10,000, and these cities have over half of the basin's population. The population is increased materially during the vacation season by the thousands of tourists and vacationists who patronize the resorts and recreational areas of the basin.

Water Use and Water Quality Objectives

The basin's waters are used for municipal, domestic, and industrial supplies; stockwatering; fish and wildlife propagation; recreation; waterpower; navigation; and final disposal of wastes.

Approximately 900,000 people, half of the basin's population, are served by municipal water supplies using surface water as a source. A number of households, resorts, camps, and others also depend upon surface water for their domestic supply. Five of the 12 municipalities using surface water secure their supply from the Mississippi River while the other seven use lakes and smaller streams. The quality of finished water for municipal supply depends, to a considerable degree,

Preceding page blank

upon the quality of the raw water used. The quality of the water used for individual domestic supplies is that found at the source as such water is seldom treated or sterilized before use. Therefore, source water quality objectives are among the factors considered when determining the treatment requirements for pollution sources upstream from such supplies. In determining the suitability of water sources for municipal and domestic supplies, State health and water pollution control officials use Public Health Bulletin 296, "Manual of Recommended Water Sanitation Practice," and comparable State manuals as guides.

Large industries of the basin also use the surface waters as their source of supply. Water quality requirements for these industrial supplies vary, and no specific criteria can be adopted as each case must be considered separately in light of the specific needs of the industry involved. Of general concern, however, are the organic and biological constituents, toxic, taste and odor-producing substances, and properties of corrosion, encrustation, and slime formation.

The streams and lakes receive heavy recreational use, including sports fishing, swimming, camping, and boating. There are numerous recreational developments, swimming areas, and National and State parks in the basin where camping, swimming, boating, and other recreational facilities are available. Quality objectives for the bacteriological quality of bathing waters recommended by the Joint Committee on Bathing Places,[1] together with sanitary surveys and comparable State criteria are employed in the administration of the basin's pollution control programs as related to bathing waters. Although quality objectives for water used for non-swimming recreation do not set forth as high a bacteriological criterion, the same fundamentals are used by the States in their programs concerning these uses.

Water quality objectives for stockwatering have not been precisely defined, but the authorities agree that the elimination of such pollution as floating and settleable solids and high bacterial concentrations is desirable. For fishing waters, the general objectives advocated by the U. S. Fish and Wildlife Service calling for a balanced aquatic life habitat and limiting concentrations of pollutional substances are usually used by authorities in this basin. These and other water quality objectives used by the State agencies are discussed in more detail in the body of this report in the section entitled "Uses of Water Resources."

Ample flow, favorable river gradients, and the topography of the surrounding land make many streams of this basin conducive to the development of water power, and there are several hydroelectric projects in the basin. Commercial navigation is generally confined to the Mississippi River. The basin's waters also serve as final outlets for the wastes of its communities and industries.

Sources and Effect of Pollution

Treated, partially treated, and untreated wastes from 139 sewered communities and 137 separate industrial waste outlets are discharged to the basin's waters. These wastes have a known combined pollution load equivalent to the sewage from about 1,969,000 people.

Seventy-three percent of the basin's population reside in the communities that have sewerage systems, and over 1,133,000 of these people are served by the municipal sewerage systems. The Minneapolis-St. Paul Sanitary District and South St. Paul are discharging wastes which have, after treatment, a combined population equivalent[2] of 1,325,000, which is more than the total sewered population of the basin.

Industrial organic wastes with a combined population equivalent of about 510,000 are being discharged through separate outlets by 77 industries, two of which contribute 458,000 of this amount. The amount of pollution entering the streams from the waste outlets of 52 industries discharging organic wastes has not been determined. Fourteen industries are discharging inorganic wastes.

---

[1] Joint Study of the American Public Health Association and Conference of State Sanitary Engineers, covered in a report entitled "Recommended Practice for Design, Equipment, and Operation of Swimming Pools and Other Public Bathing Places," 1949.

[2] Population equivalent (P.E.) is a method of expressing the amounts of organic waste in terms of an equivalent number of persons. The calculated population equivalent is based on 0.167 pounds of biological oxygen demand (B.O.D.) per capita per day. This is a measure of the amount of oxygen resources of the receiving stream which will be utilized in the oxidation process. It is not in itself a measure of health hazard.

One hundred fifteen of the 139 sewered communities in this basin provide treatment for their wastes, and the wastes from only 57,460, or about 5 percent of the sewered population, are discharged to the watercourse untreated. Forty-eight of the 117 existing municipal sewage treatment plants are considered to have inadequate capacity to handle their present load, while 37 plants do not operate satisfactorily. Seventy-three of the 137 industries with separate outlets provide some degree of treatment for their wastes, but 36 of these do not have adequate capacity to satisfactorily handle their present waste load.

Pollution has damaged water uses in certain areas of the basin, and most of this damage has been the result of depleted dissolved oxygen or high coliform bacterial counts in the waters. Fishing and recreational water uses have been most commonly damaged by pollution as depleted oxygen, high bacterial counts, excessive turbidities, and solids deposition all affect these uses.

Sport fishing and bathing are reported to be damaged in some reaches of the Mississippi River with bathing the most severely affected because of the high bacterial concentrations. While the sewage pollution results in bacterial hazard to health, it does not appear to be more than locally detrimental to biological stream welfare in the Mississippi River. Streams in Iowa have been damaged to some extent for stockwatering use. Pollution has at times been so severe as to cause nuisance conditions on some of the streams in Minnesota immediately below the waste outlets of a few of the municipalities.

In Wisconsin extremely high B. coli indices have been found in several of the streams below sewage and industrial waste outlets. Indices of one to ten million have occurred with one water sample reaching 100 million. Surveys revealed damage to biological life below many of the waste outlets. The critical areas of pollution in the basin are discussed in more detail in the section of this report entitled "Damages to Water Resources from Pollution."

Progress in Pollution Abatement

The water pollution control agencies of the States are actively working on the pollution problem and are using existing authority in a judicious and effective manner. They work cooperatively with municipalities and industries in solving pollution problems and enforcing existing statutes. Their pollution control programs and the cooperation of the municipalities with these programs have resulted in sewage treatment facilities being provided by 115 of the basin's 139 sewered communities. The existing sewage treatment plants serve 95 percent of the basin's total sewered population. Seventy-three of the 137 industries that have separate outlets to the basin's streams have facilities providing some degree of treatment to their wastes.

The water pollution control laws of the States in this basin are adequate to abate existing pollution and to prevent or control new or increased sources of pollution, and the States' activities are directed toward this end. Minnesota and Wisconsin have agreed upon a specific water pollution control program to be followed by those States insofar as the portion of the Mississippi River bounding the two States is concerned. An agreement has also been signed by Illinois, Iowa, and Wisconsin which specifies the water pollution control requirements to be applied to the portion of the Mississippi River common to those three States. The efforts of the State water pollution control agencies have been very successful, but they must be furnished with adequate appropriations to attract and hold sufficient qualified personnel if they are to continue their effective and active programs.

Pollution abatement and control is advancing in the basin with three municipal and two industrial waste treatment facilities under construction at the present time. Five industries and 19 municipalities have final plans approved and ready for construction, while 20 other municipalities and 33 industries are actively planning for the waste treatment facilities that they need.

Pollution Prevention Measures Required

Excellent progress has been made on the control of pollution during recent years, but there are still a number of projects that must be constructed to adequately control or prevent all damaging pollution. Analysis of the available data which show stream characteristics, the amount of waste discharged to the watercourse, present water quality in the streams, and existing water uses in relation to generally accepted water quality objectives has made possible the determination of treatment requirements for the major sources of pollution in this basin. This shows a need for 35 new sewage treatment plants, nine of which are needed to replace existing plants. The other 26 new plants are needed for communities that are now discharging untreated sewage. Enlargements or additions are needed at 33 existing sewage treatment plants, while six need to provide chlorination facilities and eight should remove excess storm water from the sanitary sewers connected to the treatment plant.

Sixty-four new industrial waste treatment works are needed at industries that do not now have treatment facilities, and two new plants are needed for the sanitary sewage from pulp and paper mills that have facilities for treatment of their industrial waste but not the sanitary sewage. Two of the industries have existing plants that should be replaced, and 33 need enlargement or additions to bring them up to the capacity required to reduce to an acceptable level the industrial pollution load they now discharge to the streams of the basin. Many of these needed facilities will be small, but others will, no doubt, involve considerable construction and expense.

Determination of the exact total pollution load from all municipalities and industries would require securing additional data. This is not warranted since the data now available are sufficient for the continuation of the comprehensive program and the elimination of many of the problems that now exist.

Water Pollution Control Program

The needed improvement measures discussed herein and listed below are based upon studies and observations by the responsible water pollution control agencies in the States concerned. In some cases, these studies did not include investigation of pollution conditions in the receiving stream. The projects are recommended on the premise of providing new treatment facilities where such facilities do not now exist, and expansions and improvements to existing facilities where they are now not entirely adequate to protect the stream under all conditions. Thus the fact that they are included in the listing does not always indicate the existence of a pollutional condition in the stream which is seriously damaging to water use. Nevertheless, they are deemed advisable for restoring, preserving or protecting the stream for all legitimate water uses, including those that now exist and those that may materialize in the foreseeable future.

The corrective measures listed below are flexible and are intended to reflect the needs for the present situation as it now exists; however, changes in stream characteristics, pollutional load, or water uses may require revisions in the indicated required treatment at some future date.

The essential elements of the program as developed by the States concerned consist of the following:

1. Operate all existing and future waste treatment works at an efficient and high level in order to obtain maximum benefits from these facilities and permit their most effective utilization.

2. Continue the policy of requiring adequate treatment of wastes from both new sources and expanded use of existing facilities in order to preclude new pollution problems.

3. Provide the following improvements:

Name and Location	Improvement Needed	Remarks
IOWA		
Cresco	Enlargement of existing treatment plant	Plans approved
Decorah	Enlargement of existing treatment plant	
Lansing	New treatment plant	
McGregor	New treatment plant	
Marquette	New treatment plant	Active planning
Monona (North Plant)	Additions to existing treatment plant	

Name and Location	Improvement Needed	Remarks
IOWA (Contd.)		
Postville		
Farmers Coop. Cry. Co.	New treatment plant	
Waukon	Replacement of existing treatment plant	
MINNESOTA		
Cannon Falls	New treatment plant	Plans approved
Mineral Spgs. Sanat.	Enlargement of existing treatment plant	Active planning
Claremont	Enlargement of existing treatment plant	
Claremont Cry. Assn.	New treatment plant	Plans approved
Dodge Center	Enlargement of existing treatment plant	
Faribault	New treatment plant	Plans approved
Walcott Farm Sch. & Col.	Replacement of existing treatment plant	Active planning
Faribault Cannery	New treatment plant	Plans approved
Farmington	Replacement of existing treatment plant	Plans approved
Grand Meadow	Enlargement of existing treatment plant	Plans approved
Harmony	Replacement of existing treatment plant	Under construction
Hastings	New treatment plant	Active planning
Houston	Enlargement of existing treatment plant	
Lakeville	Additions to existing treatment plant	
LeRoy	New treatment plant	
Mazeppa	New treatment plant	
Northfield	New treatment plant	Plans approved
Orono Twp.		
Mather Cheese Co.	New treatment plant	
Owatonna	Enlargement of existing treatment plant	Active planning
Owatonna Canning Co.	Enlargement of existing treatment plant	Active planning
Pine Island	New treatment plant	Active planning
Preston	New treatment plant	Plans approved
Red Wing	New treatment plant	
State School for Boys	New treatment plant	
St. Charles	Replacement of existing treatment plant	Plans approved
St. Paul Park	New treatment plant	Under construction
South St. Paul	Enlargement of existing treatment plant	
Spring Grove	Enlargement of existing treatment plant	

Name and Location	Improvement Needed	Remarks
MINNESOTA (Contd.)		
Wanamingo	New treatment plant	
Wayzata	Enlargement of existing treatment plant	Under construction
Winona		
Swift & Co.	New treatment plant	Under construction
Zumbrota	New treatment plant	
WISCONSIN		
Alma	Chlorine facilities	Active planning
Altoona		
C. St.P. M. & O. R.R.	New treatment plant	
Arcadia	New treatment plant	Plans approved
A. G. Coop. Cry.	New treatment plant	Active planning
Arkansaw		
Rochester Dairy Coop.	New treatment plant	
Augusta		
Dairy Maid Coop.	New treatment plant	
Baldwin	Enlargement of existing treatment plant	
Bangor	Additions to existing treatment plant	
Black River Falls	Chlorine facilities	
Blair	New treatment plant	Plans approved
Blair Packing Co.	Replacement of existing treatment plant	
Preston Coop. Cry.	New treatment plant	Active planning
Boyceville		
Annis Creek Cheese Fct.	New treatment plant	Active planning
Boyceville Farmers Coop. Cry.	New treatment plant	Active planning
Boyd	Chlorine facilities	
Maple Hill Coop.	Additions to existing treatment plant	
Brill		
Brill Coop. Cry.	New treatment plant	
Bruce	Chlorine facilities	Plans approved
Butternut	Additions to existing treatment plant	Active planning
Northern Hardwood Veneers	New treatment plant	
Cadott		
Clear Creek Cheese Fct.	Additions to existing treatment plant	

Name and Location	Improvement Needed	Remarks
WISCONSIN (Contd.)		
Cadott		
Hillside Dairy	New treatment plant	Active planning
Little Drywood Cheese Fct.	New treatment plant	
Campia		
Campia Butter & Cheese Co.	Additions to existing treatment plant	
Cashton	Enlargement of existing treatment plant	Active planning
Cashton Coop. Cry. Assn.	Enlargement of existing treatment plant	
Chaseburg		
Chaseburg Cheese Fct.	New treatment plant	
Chetek	Enlargement of existing treatment plant	Active planning
Chippewa Falls		
Lafayette Cry.	New treatment plant	Active planning
Tilden Cry. Co.	Additions to existing treatment plant	
Clayton		
Stella Cheese Co.	Enlargement of existing treatment plant	
Cochrane		
Garden Valley Coop. Cry.	New treatment plant	
Conrath		
Conrath Coop. Dairy Co.	Enlargement of existing treatment plant	Active planning
Cornell		
Cornell Paperboard Prods.	Additions to existing treatment plant	Active planning
Coon Valley	Additions to existing treatment plant	
DeSoto		
DeSota Cry.	New treatment plant	
Dodge		
Dodge Cry.	New treatment plant	
Downing		
Armour & Co.	Additions to existing treatment plant	Active planning
Connorsville Coop. Cry.	New treatment plant	
Durand	New treatment plant	Plans approved
Durand Canning Co.	New treatment plant	
Lakeside Butter Co.	New treatment plant	
Tarrant Coop. Cry.	New treatment plant	

Name and Location	Improvement Needed	Remarks
WISCONSIN (Contd.)		
Eau Claire	Enlargement of existing treatment palnt	Plans approved
Eau Claire Sand & Gravel Co.	New treatment plant	
Gibson Dairy	Additions to existing treatment plant	
Sterling Pulp & Paper Co.		
Pulp wastes	Waste reduction	Active planning
San. sewage	New treatment plant or connect to city sewers	
U. S. Rubber Co.	New treatment plant	Active planning
Wissota Sand & Gravel Co.	New treatment plant	
Eau Galle		
Eau Galle Cheese Fct.	Additions to existing treatment plant	Active planning
Eleva	Chlorine facilities	
Pleasant Valley Coop. Cry.	New treatment plant	Active planning
Ellsworth	Replacement of existing treatment plants	Active planning
Ellsworth Coop. Cry.	Enlargement of existing treatment plant	Active planning
Elmwood	Enlargement of existing treatment plant	
Fairchild		
Southside Cheese Fct.	Enlargement of existing treatment plant	Active planning
Fall Creek		
Luddington Coop. Cry.	Additions to existing treatment plant	Active planning
Ferryville		
Ferryville Cheese Fct.	Additions to existing treatment plant	
Fifield		
Ladysmith Milk Prod. Corp.	New treatment plant	
Fountain City	New treatment plant	Plans approved
Fountain City Brewing Co.	New treatment plant or connect to city sewers	Plans approved
Fountain City Coop. Cry.	New treatment plant or connect to city sewers	Plans approved
Genoa		
Genoa Coop. Cry.	New treatment plant	
Gilman		
Drangle Foods Inc.	Additions to existing treatment plant	
Progressive Cheese Fct.	New treatment plant	
Gilmanton		
Gilmanton Coop. Cry.	New treatment plant	
Glenwood	Enlargement of existing treatment plant	Active planning

Name and Location	Improvement Needed	Remarks
WISCONSIN (Contd.)		
Granton	Additions to existing treatment plant	
Lynn Dairy	New treatment plant	
South Grant Cheese Plant	New treatment plant	Active planning
Graytown		
Graytown Cheese Fct.	New treatment plant	
Greenwood	Additions to existing treatment plants	
Haugen		
Bear Lake Cheese Fct.	New treatment plant	Active planning
Hawkins	Additions to existing treatment plant	
Hawkins Cheese Fct.	Additions to existing treatment plant	
Hixton		
Northfield Coop. Cheese Fct.	Additions to existing treatment plant	
Holcombe		
Holcombe Dairy	New treatment plant	
Holmen		
Holmen Coop. Cry. Assn.	New treatment plant	
Humbird		
Humbird Cheese Fct.	Additions to existing treatment plant	Plans approved
Independence	Replacement of existing treatment plant	Plans approved
Jim Falls		
Falls Dairy Co.	Additions to existing treatment plant	
Knapp		
Knapp Creamery Co.	New treatment plant	
LaCrosse		
Holy Cross Seminary	Chlorine facilities	
Ladysmith		
Grow Coop. Cry. Assn.	New treatment plant	
Peavy Paper Mills		
Ind. Waste	Waste reduction	
San. Sewage	New treatment plant or connect to city sewers	
Loyal	Additions to existing treatment plant	Active planning
Pine Grove Cheese Fct.	New treatment plant	Active planning
Maiden Rock		
Ellsworth Coop. Cry.	New treatment plant	

Name and Location	Improvement Needed	Remarks
WISCONSIN (Contd.)		
Menomonie	Additions to one existing treatment plant	
Teagarden Coop. Cheese Fct.	New treatment plant	Active planning
Merrillan	New treatment plant	Plans approved
Modena		
Modena Coop. Cry.	New treatment plant	Active planning
Mondovi		
Mondovi Canning Corp.	New treatment plant	Under construction
Neillsville	New treatment plant	Active planning
North Bend		
North Bend Coop. Cry.	New treatment plant	Active planning
Ogema		
Ogema Creamery	Additions to existing treatment plant	
Osseo	Enlargement of existing treatment plant	
Foster Coop. Cry.	New treatment plant	
Osseo Coop. Cry. Co.	New treatment plant	Active planning
United Milk Products Co.	New treatment plant	Active planning
York Coop. Cry. Assn.	New treatment plant	
Park Falls		
Flambeau Paper Co.		
Pulp Wastes	Enlargement of existing treatment plant	Active planning
Phillips	Additions to existing treatment plant	Plans approved
Pigeon Falls		
Pigeon Falls Coop. Cry.	New treatment plant	
Plum City	Additions to existing treatment plant	
Prairie du Chien	New treatment plant	Active planning
National Decorating Metal Co.	New treatment plant	
Prairie Farm		
Pine Grove Cheese Fct.	New treatment plant	Active planning
Pleasant Creek Cheese Fct.	Additions to existing treatment plant	Active planning
Sheridan Cheese Fct.	New treatment plant	
Prentice		
Ladysmith Milk Prod. Coop.	Additions to existing treatment plant	
Northwest Dry Milk Co.	Additions to existing treatment plant	
Rice Lake		
Johnson Welding Mfg. Co.	New treatment plant	
Red Cedar River Coop. Ch. Fct.	New treatment plant	

Name and Location	Improvement Needed	Remarks
WISCONSIN (Contd.)		
Rice Lake Tuscobia Cheese Fct.	Additions to existing treatment plant	Active planning
Ridgeland Foremost Dairies, Inc.	New treatment plant	
Sand Creek Falls Dairy Co.	Replacement of existing treatment plant	
Sheldon Sheldon Creamery	New treatment plant	Active planning
Stanley Brownsville Cheese Fct.	Additions to existing treatment plant	
Strum Unity Coop. Cry.	New treatment plant	
Thorp	Additions to existing treatment plant	
Lombard Dairy	Additions to existing treatment plant	Active planning
Reseburg Cheese Fct.	Additions to existing treatment plant	
Trempealeau Centerville Coop. Cry.	New treatment plant	Active planning
Viroqua	Additions to existing treatment plant	
Viroqua Coop. Cry.	Enlargement of existing treatment plant	
Westby Esofea Cheese Fct.	New treatment plant	
West Salem	New treatment plant	Active planning
LaCrosse County Asylum	Connect to city sewers	
Whitehall	New treatment plant	Plans approved
Willard Gorman Coop. Cry.	Enlargement of existing treatment plant	Active planning
Wilson Summit Cheese Fct.	Additions to existing treatment plant	Active planning

Part II
PHYSICAL DESCRIPTION

This basin includes the drainage area of the Mississippi River from the northern edge of Minneapolis, Minnesota, to McGregor, Iowa, and the drainage areas of the tributaries entering the main stream between these two points, except those of the Minnesota and St. Croix Rivers. The basin is roughly triangular with the apex in Wisconsin near Lake Superior and the base in southeastern Minnesota and northeastern Iowa. The longest axis of the basin is about 230 miles and lies in a northeast-southwest direction, while the greatest width of 180 miles occurs near the base of the triangle at right angles to this axis. The basin contains an area of slightly more than 23,000 square miles with 64 percent in Wisconsin, 30 percent in Minnesota, and 6 percent in Iowa.

The Mississippi River drops about 190 feet in its 230 mile southeasterly course through the basin. The upper portion of the river forms part of the boundary between Minnesota and Wisconsin, and the lower part a boundary between Wisconsin and Iowa. The principal tributary, the Chippewa River, rises in Iron County, Wisconsin, and flows generally southwestward for 220 miles draining an area of 9,480 square miles. Other important tributaries are the Cannon, Zumbro, Root, Trempealeau, Black, LaCrosse, and Upper Iowa rivers.

Much of the watershed is gently rolling or hilly with portions in northern Wisconsin as much as 1,600 feet above sea level. Numerous lakes and swamps and the forests in the northern area prevent rapid run-off of rainfall, thus maintaining a naturally uniform flow in the streams. A considerable portion of the lower end of the basin is known as the driftless area since it was not covered during the glacial periods.

Loess or stratified clay soils, which in places are very sandy, cover the basin. The area was originally blanketed with one of the richest stands of timber in the entire United States with pine, oak, birch, maple, ash and spruce among the many varieties present. Most of this timber was removed during the lumbering era, but reforestation is now being practiced in some areas. However, large tracts of the cutover area were developed into productive farm land.

The basin has a continental climate with only slight variations existing between the northern highlands and the central lowlands. The average annual precipitation varies from 27 to 32 inches, two-thirds of which occurs during the 160-day growing season, from April to September, inclusive. The average annual snowfall is about 40 inches. Temperature extremes have ranged from -40°F. to 110°F., with an average January temperature of about 14°F., and an average July temperature of approximately 72°F.

The Mississippi River has a comparatively flat gradient of 0.83 feet per mile through this drainage basin. Some of the tributaries have much steeper gradients that are utilized in many places for the development of power. The Chippewa River has carried a large amount of sand and gravel into the Mississippi which has created a natural dam and resulted in the formation of a large lake. This lake, called Lake Pepin, is about two miles wide and 20 miles long and is one of the most beautiful bodies of water in the midwest.

Stream gradients of the Mississippi River and many of the tributaries are favorable for the development of power, and many hydroelectric plants and dams, which have some regulating effect on stream flows, have been constructed. The Flambeau River is an excellent power stream as it has an average fall of 4.1 feet per mile, and this is greatly exceeded above Eau Claire, Wisconsin. In addition to the present power developments, there are potential sites in the basin which could be developed for an additional 260,000 horsepower.

About one-fourth of the average annual precipitation appears in the streams as runoff. Most of the rivers are steady flowing or "firm" streams, but a few are flashy streams that occasionally give some trouble due to flooding. Minimum flows in the Mississippi River and its tributaries within the basin usually occur in August-September and again in January-February. Stream flow data for the Mississippi River and some of the major streams of the basin are as follows:

STREAM FLOW DATA AT VARIOUS LOCATIONS IN THE LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

(through Water Year 1951)

River and Gauging Station	Drainage Area in Sq. Mi.	Years of Record	River Discharge in Cu. Ft. per Second			
			Average	Maximum	Minimum	Average During Driest Month
Mississippi River St. Paul, Minn.	36,800	59	9,535	107,000	632	864
Mississippi River McGregor, Ia.	67,500	15	32,200	185,700	6,200	7,665
Chippewa River Bruce, Wis.	1,602	37	1,411	25,800	155	296
Chippewa River Durand, Wis.	9,010	23	7,336	93,600	1,020	2,026
Flambeau River Ladysmith, Wis.	1,823	37	1,714	19,500	18	301
Red Cedar River Menomonie, Wis.	1,760	36	1,218	40,000	21	383
Zumbro River Zumbro Falls, Minn.	1,130	30	471	30,700	27	90
Black River Galesville, Wis.	2,120	19	1,678	58,000	180	295
Root River Houston, Minn.	1,270	30	658	26,600	65	178
Upper Iowa River Decora, Iowa	560	25	338	28,500	10	30

ECONOMIC DEVELOPMENT

This basin is well suited for agriculture. Most of the area in Iowa and Minnesota and about 75 percent of that in Wisconsin are under cultivation or in grassland. In addition to dairy and livestock products, large crops of corn, wheat, barley, oats, and soybeans are produced. Truck farming is of considerable importance near the large population centers and in areas within trucking distance of canning plants. About 25 percent of the Wisconsin portion of the basin is now in second growth timber, and timber farming is gaining in popularity.

The most important industrial developments in the basin are the mills and plants processing farm and forest products. These include pulp and paper mills, lumber mills, flour mills, creameries, cheese factories, meat packing plants, breweries, etc. Other important industrial activities are printing and publishing, chemical manufacturing, machinery and fabricated metal production, and the production of stone, clay, and glass products.

In 1950 estimated population of the basin was 1,802,000 persons, of which 72 percent live in Minnesota, 25 percent in Wisconsin, and 3 percent in Iowa. The population increased more than 11 percent in the 1940-50 census decade, most of this increase occurring in the larger cities and metropolitan areas. The rural areas lost population with more than half of the counties of the basin showing marked decreases.

Minneapolis, with a population of more than one-half million, and St. Paul, with slightly over 300,000, are the largest cities in the basin. The next twelve largest cities have populations ranging from 47,396 to 10,191. There are twelve cities with populations between 5,000 and 10,000, and fifteen cities in the 2,500-5,000 bracket. Population concentrations vary widely throughout the area from about five persons per square mile in Iron County, Wisconsin, to 2,680 persons per square mile in the Minneapolis-St. Paul metropolitan area of Ramsey County, Minnesota. In some areas there is a decided seasonal fluctuation in population due to the influx of many thousands of tourists and vacationists.

The water resources in this basin have been, and continue to be, important to the economic development of the area. Initially the waterways were utilized as routes of communication by which people and supplies entered the area, and products were shipped out. The Mississippi River waterway remains one of the most important in the country.

As the area developed, the importance of domestic and industrial water supply grew until its value exceeded that for navigation. The industrialization of the area also developed a need for power, part of which was obtained by harnessing the rivers.

The improvement of the national system of roads and railroads, together with the increase of leisure time, has enabled large numbers of people to become familiar with this area. The appeal of the wooded shores and the wildlife of the lakes and streams of the area is great and, as a result, the development of the recreational facilities has been rapid. Today recreation ranks as the States' fourth largest industry.

The average per capita buying income in the basin was $1,337 in 1950, which was just above the national average of $1,311. The distribution of the basin income ranged from $531 in Anoka County, Minnesota, to $1,657 in Hennepin County, Minnesota. Minneapolis-St. Paul ranked thirteenth in population among the 162 metropolitan county areas of the United States and also ranked thirteenth in net effective buying income.

MINNESOTA
IOWA

MINNESOTA
IOWA

SCALE OF MILES
10 5 0 10 20 30 40

LOWER POTOMAC [illegible]
[illegible]
[illegible]
U.S. DEPARTMENT OF
HEALTH EDUCATION AND WELFARE
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
[illegible]

USES OF WATER RESOURCES

Important uses of the basin's waters include those for domestic, livestock, and industrial supplies, bathing and other recreation, wildlife, navigation, and final waste disposal. The primary use in some areas is for industrial and domestic supply, but the predominant use throughout the basin is for livestock watering, sport and commercial fishing, hunting, and recreation.

The twelve municipalities which obtain their water supplies from surface sources had a 1950 population of approximately 895,000, and served 852,000 of these with about 77,000,000 gallons per day. Five of these communities secure their water from the Mississippi River, while the other seven use lakes or smaller streams as their source of supply. A large number of households, camps, and others depend upon surface water for their individual domestic supply. Underground water supplies are used by 152 communities to supply 310,000 people with 27,800,000 gallons per day.

Source water quality objectives are among the factors considered in determining treatment requirements for wastes discharged upstream of municipal and domestic supplies. In appraising the suitability of water sources for such supplies, and in developing waste treatment requirements to insure a satisfactory source water quality, State health and water works officials use Public Health Bulletin 296, "Manual of Recommended Water Sanitation Practice," and comparable State manuals as guides.

The amount of surface water used by industry for cooling or process purposes, with or without treatment, is not known, but it seems reasonable to assume that, with the importance industry has reached throughout much of the basin, the quantity required and used is large. Because of the diversity of uses, quality requirements for industrial water supplies vary widely, depending upon the particular needs of each industry. No general criteria have been adopted as each case must be considered separately. Of general concern, however, are the organic and biological constituents, toxic substances, and properties of corrosion, encrustation, and slime formation of the available waters.

The raising of dairy and other livestock is a primary agricultural activity of great economic importance to this basin. The use of surface water for livestock water supply is widely practiced and of paramount importance in the production of high quality livestock. Water quality objectives for stockwatering have not been precisely defined, but elimination of such pollution as floating and settleable solids, high bacteria counts, and toxic materials will generally provide water quality satisfactory for stock use.

The lakes, streams, and scenic areas within the basin provide sport fishing, hunting, swimming, skating, boating, camping, picnicking, and other forms of recreation. The lakes and larger streams contain northern and walleyed pike, bass, perch, muskellunge, and pickerel, while the temperatures and dissolved oxygen content of the waters in the majority of the smaller streams are suitable for trout.

The 1952 commercial fish catch from the Mississippi River Pools 1-9 amounted to 2,884,611 pounds according to the Upper Mississippi River Conservation Committee. Approximately 60 percent of the fish were carp, 15 percent buffalo, 10 percent sheephead, 10 percent catfish and 5 percent other fish. The most prolific producer of commercial fish in the basin is Lake Pepin, which produces about 88 pounds per acre, whereas the average for the entire river is about 16 pounds per acre. Over 2,151,000 pounds of fish were obtained from Lake Pepin in 1947, while the 1938 catch from this lake was over 3.5 million pounds.

Water quality objectives for fishing waters depend upon the type of aquatic life to be protected. The general objectives advocated by the U. S. Fish and Wildlife Service calling for a balanced aquatic life habitat and limiting concentrations of pollutional substances are usually used by authorities in this basin. Toxic and oxygen-consuming wastes and those which form sludge beds, silt, and other deposits which blanket the stream bottom destroy biological life and consequently are considered undesirable.

Hunting is popular in the basin and while not a direct water use, it depends, to a large extent, upon the game attracted to the area by the presence of suitable water. Hunting camps and lodges are generally located where an ample supply of good water is available for domestic use, as well as for aesthetic enjoyment.

The waters of the basin are widely used for boating, swimming, and other forms of aquatic recreation and as background settings for camping and picnicking.

Contamination of bathing and recreational waters by sewage and industrial wastes, especially that of recent origin, is objectionable as water for such use should be free from floating solids, sludge deposits, odors, and discoloration. Quality objectives for the bacteriological quality of bathing waters as recommended by the Joint Committee on Bathing Places,[3] together with sanitary surveys and comparable State criteria are employed in the administration of pollution control programs as related to bathing waters of this basin. Under the Joint Committee interpretation, various classifications of waters are defined as based on the number of coliform organisms per 100 milliliters of water; however, other indices of quality, such as enterococci, are beginning to receive attention. Although quality objectives for water uses for non-swimming recreation do not set forth as high a bacteriological criterion, the same fundamentals are used by the States in their programs for these waters.

Ample and "firm" flow, favorable river gradients, and the topography of the area make the streams of this basin especially well suited for the development of water power. The power needs of the paper industry and others have led to the installation of power dams at several locations in the watershed. These power developments are listed below.

River	Number of Plants	Installed Capacity Kilowatts	Installed Capacity Horsepower
Cannon	1	1,900	2,547
Zumbro	1	1,840	2,467
Root	2	977	1,310
Upper Iowa	2	1,080	1,448
Chippewa	6	113,090	151,597
Flambeau	9	30,400	40,751
Red Cedar	5	8,970	12,024
Black	3	5,810	7,790
LaCrosse	3	415	556
Mississippi	6	36,625	49,095
Total	38	201,107	270,870

Navigation has had an important role in the development and growth of the basin. The streams and lakes, first used as the main avenues of traffic for the early fur traders and settlers, were also used to move the basin's lumber to market as the timber resources were developed. Navigation is now confined to the Mississippi and the lower reaches of some of the larger tributaries with the exception of pleasure and fishing craft which use many of the lakes and streams. About $150,000,000 was spent for the construction of 26 navigational dams located between Alton, Illinois, and Minneapolis, Minnesota. Ten of these are in this basin. The freight traffic moving into and out of Minneapolis and St. Paul over the Mississippi River amounted to over 1,500,000 tons in 1948. The major incoming freight consists of bituminous coal and gasoline, while grains make up the bulk of the outgoing freight.

Waters used for power and navigation purposes should be free of sludge, silt, and other materials which tend to settle behind dams and in navigation channels and reduce the effective capacity of such facilities. They should also be free of corrosive materials which attack and damage structures and equipment.

All the above water uses are considered essential for the economy and the health and welfare of the people of the basin, and the water resources must be protected from pollution to permit continued development of the area. Treatment of the wastes discharged to the watercourses will be necessary to achieve pertinent water quality objectives and to maintain the streams and lakes of the basin in a suitable condition for the indicated water uses.

---

[3] See footnote 1, page 4.

POLLUTION DISCHARGED TO SURFACE WATER

The sources of untreated, partially treated, and treated wastes that are discharged into the surface waters of the basin are tabulated in the Appendices and summarized in Tables A and B. Four of the 276 sources of pollution are discharging wastes which have a total combined population equivalent[4] of 1,781,000—more than the basin's entire population.

The magnitude and importance of industrial wastes are further illustrated in the case of the Minneapolis-St. Paul Sanitary District and the city of South St. Paul. The Minneapolis-St. Paul Sanitary District provides primary treatment for the wastes from approximately 600,000 people and miscellaneous industry within the district. A residual waste with a population equivalent of 750,000 is discharged to the river despite efficient treatment. At South St. Paul the industrial load is so great that it is probably a mistake to classify this plant as a municipal plant, although it is owned and operated by the city and serves its population of 10,000. After secondary treatment consisting of two-stage trickling filters, the residual waste discharged to the river has a population equivalent of 575,000.

The remaining two major sources of pollution are the Sterling Pulp and Paper Company at Eau Claire, Wisconsin, and the Flambeau Paper Company at Park Falls, Wisconsin. While both of these industries provide primary treatment, the residual discharged at the Eau Claire plant has a population equivalent of 181,200, and the Park Falls plant has a residual of 274,800.

TABLE A
SEWERED MUNICIPALITIES*

Municipalities*	Number	Population Served by Sewerage System	Amount of Pollution Discharged to Watercourse (in terms of equivalent number of people)
Having data on pollution load discharged to watercourse	51	959,705	1,458,765
Having population data available. (Data on pollution load to the watercourse incomplete or not available)	88	173,865	not applicable
TOTAL	139	1,133,570	XXX XXX

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers, or other population centers; and industrial wastes discharged into municipal severage systems.

One hundred fifteen of the sewered municipalities provide sewage treatment facilities for their wastes. However, the pollution control secured by some of the sewage treatment plants is not entirely satisfactory at present because they are not operated at maximum efficiency, while other plants do not have adequate capacity or the necessary facilities to produce the degree of treatment now required by the water uses downstream. Forty-eight existing plants no longer have adequate capacity to handle the loads imposed on them and they are unable to reduce the pollution characteristics of the waste to the extent needed. Operation at 37 plants is not considered to be entirely satisfactory and pollution is not controlled as well as it could be by efficient use of existing facilities. Twenty-seven municipalities do not treat the wastes they collect from their combined population of 57,460 and their connected industries. The largest of these is Faribault, Minnesota, which serves a population of 13,000. Five of the other municipalities that discharge untreated wastes each serve 2,500 or more people.

---

[4] See footnote 2, page 4.

A summary of the industrial sources of pollution which discharge their wastes directly into the basin's watercourses is given in Table B. These sources are also shown in Table D of the section of this report dealing with prevention measures in effect, where they are tabulated according to the type of industry and the treatment provided for the wastes.

TABLE B
SEPARATE INDUSTRIAL OUTLETS*

Industries	Number	Amount of Pollution Discharged to Watercourse (in terms of equivalent number of people)
Producing organic wastes	77	510,452
Producing organic wastes	52	Undetermined
Producing inorganic wastes	14**	Not applicable
TOTAL	137***	XXX XXX

*Industries having separate outlets discharging wastes directly to watercourses.

**Includes six also producing organic wastes.

***Total adjusted to correct for duplication noted in footnote**

There are 137 industrial sources of pollution which discharge their wastes directly to a watercourse and not to a municipal sewerage system. Seventy-three of these provide some degree of treatment for their waste, while the other 64 discharge untreated waste. Oxygen-consuming organic wastes are discharged by 129 industries and 14 industries discharge inorganic wastes. Detailed information on individual industrial waste sources is given in the basic data table of Appendix II.

On the basis of population equivalent, the total known sewage and organic industrial waste load discharged to the basin's watercourses is equivalent to the wastes from about 1,969,000 people. This is greater than the total basin population, although it does not include the wastes from 88 municipalities and 52 industries for which specific data have not been reported.

DAMAGES TO WATER RESOURCES FROM POLLUTION

Pollutional damages have occurred throughout this basin in localized areas. The extent of the damage incurred varies considerably in each locality and depends upon the extent to which the major existing water uses are affected and potential water uses held in abeyance by unsatisfactory water quality. Damage to water use results from contamination by bacterial pollution, de-oxygenation by organic pollution, toxicity, increased hardness, or the presence of color, odor, or taste-producing substances. Where nuisance conditions exist, all present water uses along the stream for some distance below the source of pollution are damaged and other uses are prohibited.

Sport fishing and bathing are reported to be damaged in the Mississippi River below the Minneapolis-St. Paul Sanitary District, South St. Paul, Newport, and Red Wing, Minnesota. The 1948 survey of the Mississippi River conducted by the Wisconsin Committee on Water Pollution revealed that odors and sludge banks occurred in the vicinity of Prairie du Chien with resulting nuisances. An average B.O.D. of 12 p.p.m. was found in the stream in this localized area. B. Coli indices averaged 800,000 and reached a maximum of 1,000,000. It was concluded that the Mississippi River in this area was unfit for bathing or public water supply use without special treatment. The Mississippi River was not excessively polluted, from a chemical standpoint, in the section from LaCrosse to Dubuque, except for a localized area at Prairie du Chien. Pollution conditions were also found in Half-Way Creek at Holmen, Isabelle River at Ellsworth, and LaCrosse River at West Salem. While the sewage pollution resulted in bacterial hazard to health, it did not appear to be more than locally detrimental to biological stream welfare.

Pollution is reported to have damaged stockwatering, wildlife, and recreational use of several of the streams of Minnesota. Pollution has, at times, become so severe as to cause nuisance conditions on the Vermilion River below Hastings, the Straight River below Faribault, the Zumbro River below Pine Island, the Whitewater River below St. Charles, and the Root River below Preston.

The waters of Paint Creek and Yellow River in Iowa have been damaged to some extent for stockwatering use.

In Wisconsin extremely high B. coli indices have been found in several of the streams below sewage and industrial waste outlets with several indices of 1,000,000 to 10,000,000 being recorded. Biological surveys revealed pollution conditions below many of the municipal and industrial waste outlets. Some of the most critical areas are discussed in the following paragraphs.

The Flambeau River is polluted by pulp and paper mill wastes at Park Falls, Wisconsin, causing a reduction in dissolved oxygen which has a deleterious effect on biological life. The wastes are reported to have resulted in the reduction of recreational use of the river and in the development of objectionable tastes in fish. Loss of property values and of income is also claimed. A biological survey found polluted bottom conditions for about 16 miles below Park Falls. Dissolved oxygen was depressed for distances as much as 74 miles down stream in the winter and at least 27 miles down stream during the summer.

Pulp and paper mill wastes entering the Chippewa River at Eau Claire cause reduced dissolved oxygen content of the water and have been reported to collect on and foul commercial fishing nets. Rubber plant wastes also enter the Chippewa River at Eau Claire and form deposits on the banks and bottom of the river and discolor the surface of the water. The discharge of these wastes into the river has resulted in complaints regarding the unsightly conditions of the water and adjacent areas.

Oil-bearing wastes from railroad shops at Altoona, Wisconsin, are polluting the Eau Claire River. Thorp Ditch of the North Fork of the Eau Claire River was found to be polluted, from a biological standpoint, from the Thorp sewage treatment plant outfall to a point 1.7 miles below the plant.

The Eau Galle River and Lake Eau Galle are polluted by wastes discharged from a cheese plant and also by sanitary sewage. The B. coli index per 100 ml. was found to range from 1,000,000 to 10,000,000.

Wilson Creek of the Red Cedar River was found to be polluted or semi-polluted, from a biological standpoint, for a distance of more than three miles between Knapp and Menomonie, Wisconsin.

Isabelle Creek is polluted by sewage and dairy plant wastes, and numerous complaints regarding nuisances and pollution of stockwatering supplies have been reported.

Large sludge banks have been deposited on the stream bed of Butternut Creek for a distance of at least 0.6 mile below the sewer outlet of Butternut, Wisconsin, and the stream bottom was found to be polluted from a biological standpoint.

A biological survey revealed pollution conditions in Meadowbrook Creek for at least one mile below a dairy plant waste outlet. Dairy wastes are also responsible for the pollution of one mile of Drywood Creek where the dissolved oxygen in the stream was found to be quite low with one sample having only 2.3 p.p.m.

All biological life in Rock Creek immediately above Loyal, Wisconsin, was killed in 1952 by pea vine-stack juice discharged to the stream. A water sample taken 1.4 miles below the canning plant had a very low oxygen content and only pollutional types of organisms were found on the bottom.

Although most of the pollution and water-use damage occurring in this basin is restricted to small localized areas, the condition should be corrected before growth of the communities and industries cause the pollution to spread to a point where it affects the economic welfare of the area.

BENEFITS RESULTING FROM POLLUTION ABATEMENT AND PREVENTION

Water pollution in this basin is not widespread, but there are some areas where correction of pollution conditions are necessary and desirable to restore the affected waters to their most useful condition. By abating existing pollution, the damaged water uses can be restored, and by preventing additional pollution, future water uses can be preserved. The sewage and waste treatment facilities now operating in the basin have been of great value in holding the damage of the receiving waters to a minimum and in correcting some of the damage that had developed.

Pollution abatement activities are costly, but the cost is generally well justified considering the immediate and long-range benefits which accrue. The use of the surface waters for stockwatering, commercial and sports fishing, and for recreation is of considerable benefit to the economy of the entire basin, and pollution control to protect water quality for these uses is well worth while.

One of the first studies of the direct economic effects of pollution was made in 1928 on the Mississippi River from Minneapolis-St. Paul, Minnesota, to LaCrosse, Wisconsin, by Professors Vaile and Black of the University of Minnesota. Much of the data, such as the number and strength of the sources of pollution, the number, degree, and adequacy of treatment facilities provided, as well as conditions in the stream, has changed materially since their report was prepared, but the data still have considerable value in illustrating benefits which can be derived from pollution abatement programs.

The report estimated that correction of pollutional conditions in the vicinity of St. Paul would add at least $1,000,000 to the sale value of the unoccupied real estate lots in that area in the summer of 1928. It was believed possible that at least an equal amount could be added to the sale value of vacant lots between the Ford Plant and Snelling Bridge if that area were reserved by the city for residential purposes and if the river were restored to a sanitary condition. The report stated that, under the conditions of demand as they existed at that time, a conservative estimate would add at least $500,000 to the sale value of unoccupied lots in the area around the University of Minnesota provided the objectionable conditions of the river as they then existed were removed.

From 1922 until 1928, the date of the report, there had been a marked falling off in the total catch of commercial fish taken from the river. It appeared that the condition was largely attributable to the combination of river pollution with a period of years of relatively low river discharge in the summer and fall months. It was felt that if control of pollution could restore the previous low ratio of carp to other and more valuable commercial fish, and if the total catch could be raised to equal the 1920-22 average, the annual income of fishermen on this particular stretch of the river would be increased not less than $75,000.

The authors of the report found it difficult to speak with the same degree of definiteness regarding the effects of pollution on the clamming industry, since fresh-water clams and mussels seem to thrive on a reasonable amount of pollution. However, there were clear indications that in a few areas clamming beds were buried by the sludge from sewage disposal plants and had lost their value as clamming locations. The clam harvest from Lake Pepin fluctuated from a high of nearly 4,000 tons per year to a low of approximately 200 tons per year. It was felt that an average production of 1,500 tons per year should be maintained in this area of the stream and, assuming that only one-fourth of the production loss was due to pollution, the report estimated the financial loss to be approximately $20,000 annually.

The report estimated that improvement of the sanitary condition of the water in the river would increase land values of attractive river frontage available for summer residences between Hastings and LaCrosse by about $275,000. The report stated that some expert real estate appraisers felt the values on the Mississippi River would increase to equal those of the St. Croix River under comparable natural conditions if the river were free of pollution. In this event, it was estimated that the increase in property values would be approximately $1,500,000.

A survey made of hotel and resort keepers, operators of boat liveries, and proprietors of sporting goods stores in the area indicated that the number of unit days of sport fishing on the Mississippi River and its immediate tributaries in the stretch under consideration was reduced in the 18 years prior to the report by approximately 10,000 days a year. The reduction in the total annual catch of game fish in the area was probably 100,000 fish. If these were considered to be worth 25 cents each to the catcher, the reduction of value would be $25,000 annually. It was felt that $10,000 of annual revenue from boat livery, bait sales, lodging, and catering services was lost as a result of the reduction in sport fishing.

To summarize the monetary values of the benefits which would be derived from pollution abatement in this stretch of the river, the authors estimated that capital worth increases would range from $1,775,000 to $4,000,000 and that annual income would be increased from $65,000 to $130,000, based on 1928 prices.

The above discussion of a study of the monetary benefits of pollution abatement concerned only a portion of the Mississippi River; however, other and comparable benefits could be attributed to pollution abatement in the other streams of the basin. While the economic study of the above-mentioned area has not been repeated since the construction of the Minneapolis-St. Paul sewage treatment plant, it appears that the growth and economic development of the area in recent years confirms the conclusions reached by Professors Vaile and Black in 1928. This basin area represents one of the finest recreational sites in the Middle United States and any action taken toward improving recreational opportunities will undoubtedly be reflected in increased revenue from this industry.

A good quality water supply that is palatable and free of disease organisms is essential for healthy animals and profitable livestock farming. The removal of the pollution that has damaged stockwatering supplies would be of direct benefit and result in monetary value to the dairy and livestock operators of the basin.

Good quality water is a requisite to the development of many industries and a major factor in locating industrial plants. Thus, adequate pollution control programs which insure water of desired quality are of economic importance to the basin in maintaining existing industry and in attracting new industry to the area.

POLLUTION PREVENTION MEASURES IN EFFECT

Over two-thirds of the basin's total population live in the 139 municipalities that are served by severage systems. One hundred fifteen of these communities, with a total combined sewered population of 1,076,000, have provided sewage treatment facilities. These facilities, as shown in Table C, consist of 45 primary treatment plants and 72 secondary plants.

TABLE C
EXISTING MUNICIPAL* TREATMENT FACILITIES

Degree of Treatment Provided	Number of Municipalities	Number of Plants	Population Served
Primary	43	45	938,315
Secondary	72**	72	137,795
No Treatment	27***	—	57,460

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers, or other population centers, and industrial wastes discharged into municipal severage systems.

**Includes two municipalities which also have primary plants.

***Includes a municipality which has a primary plant serving 10% of the community and discharges raw sewage from the other 90%.

As shown in Table D below, the food industry has the largest number of establishments that are discharging wastes directly to the basin's watercourses. However, the paper industry is by far the most important organic waste-producing industry from a pollution standpoint. All four of the paper mills are providing some degree of treatment, and over half of the food processing plants are treating their wastes. Industrial waste treatment facilities have been provided by 73 of the 137 industries which are discharging wastes directly to the basin's waters.

TABLE D
EXISTING INDUSTRIAL* TREATMENT FACILITIES

		Number of Industrial Plants Having:		
Type of Industry	Number of Plants	Treatment Facilities	No Treatment Facilities	Undetermined Facilities
Food and Kindred Products	121	64	57	0
Lumber and Wood Products	1	0	1	0
Paper and Allied Products	4	4	0	0
Chemical and Allied Products	1	1	0	0
Petroleum and Coal Products	2	2	0	0
Rubber Products	1	0	1	0
Fabricated Metals	2	0	2	0
Quarries	3	1	2	0
Miscellaneous	2	1	1	0
TOTAL	137	73	64	0

*Industries having separate outlets and discharging wastes directly to watercourses.

Twenty-one of the food processing plants and one miscellaneous industry have provided secondary waste treatment facilities or equivalent. Primary treatment facilities have been provided by all of the other industries that have treatment works. Primary treatment is generally sufficient to prevent damage to water uses by inorganic wastes, but primary treatment will not be adequate, in many cases, to protect watercourses from the effects of organic pollution.

A study of the adequacy of the existing treatment facilities shows that 69 of the 117 sewage treatment plants have satisfactory capacity to handle the present load, while 48 do not have adequate capacity.

TABLE E
ADEQUACY OF EXISTING TREATMENT FACILITIES

Existing Treatment Facilities	Total Number	Adequacy with relation to: Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	117	69	48	0	80	37	0
Industrial	73*	36	38	1	35	37	1

*Includes two pulp and paper mills where the paper mill waste treatment facilities have satisfactory capacity and operation and the pulp mill waste facilities have unsatisfactory capacity and operation and are, therefore, included under both categories.

Thirty-six of the industrial waste treatment plants have adequate capacity to provide sufficient treatment to protect the downstream water uses, while 36 do not. Most of the industrial plants with inadequate capacity are food processing plants that now have primary facilities, but are in need of some type of secondary treatment to remove the residual polluting material that is damaging water use.

Pollution control was initiated in the basin when Claremont, Minnesota, constructed its sewage treatment plant in 1916. Dodge Center and Farmington, Minnesota, continued the program by constructing treatment plants in 1917. Thirteen municipalities constructed plants during the 1920's, 35 others placed plants in operation between 1930 and 1940, and 26 plants were built during 1940-50.

TABLE F
PROGRESS IN POLLUTION ABATEMENT

Year	Municipal: Plants Completed	Municipal: Design Population	Industrial Plants Completed
1946	0		2
1947	0		0
1948	2	2,348	0
1949	8	30,050	0
1950	7	7,800	3
1951	4	7,520	5
1952	5	46,900	6
1953	12	31,950	10
1954	5	57,955	7

Soil conservation districts have been organized in 99 percent of the basin area in Wisconsin, in 100 percent of the area in Iowa, and in 98 percent of the area in Minnesota. The Soil Conservation Service, working through districts, provides technical assistance to the farmers in installing conservation practices, such as contour farming, contour and wind strip cropping, terracing, pasture improvement, tree planting, and improved crop rotation. Technical assistance for the design and supervision of the construction of floodwater-retarding structures, stabilizing and sediment-control structures, and waterway and channel improvements is also provided to the districts. These practices tend to reduce the sediment loads of the streams in the watershed, bringing about a reduction in the damage to fish life, silting of reservoirs and stream channels, and damage to agricultural lands.

The low-flow regulation afforded the basin portion of the Mississippi River by the six Federal headwaters reservoirs and the low-flow regulation secured on other streams through the operation of many of the power developments are of considerable aid to pollution control in this basin.

The water pollution control laws of the States are adequate to abate existing pollution and to prevent or control new or increased sources of pollution. The water pollution control agencies have been given sufficient authority to support their programs and they have used this authority judiciously and effectively in carrying out their work. The following brief analysis presents the salient features of water pollution control legislation of the States of the basin.

In Iowa the water pollution control act vests the principal authority in the State Department of Health. The Iowa Natural Resources Council and the State Geologist also have certain functions relating to water pollution. The Iowa Natural Resources Council makes surveys of health and pollution problems relating to flood control, and the State Geologist is responsible for protection of waters from pollution by oil and gas wells.

There is no specific statutory authority granted to the State Department of Health to develop a comprehensive program, to set standards of water purity, or to classify waters. However, the Department is authorized to exercise general supervision over public health, promote public hygiene and sanitation, to investigate and prevent water pollution, and to make necessary rules. The Department is authorized to issue written permits, after approval of plans and specifications, for new sewerage or industrial waste systems as well as extensions or additions which would substantially increase water pollution.

The Department may hold public hearings on water pollution and may order abatement of pollution. However, the order cannot be issued without the written approval of the majority of the members of the Iowa Natural Resources Council. Penalties are provided for violations of orders issued or for unlawful pollution of State waters.

There are no exemptions from the operation of the act since removal in 1949 of the restrictions under which the authority of the Department did not apply to the border streams. The last amendments to the existing statutes of the state of Iowa considerably strengthened previous water pollution control legislation, under which a large measure of progress was made. Disposal of garbage and night soil into streams or on land subject to overflow is prohibited by an old statute not under direct administration or enforcement by the State Department of Health.

In Minnesota, a comprehensive State water pollution control act was enacted in 1945 with authority vested in a Water Pollution Control Commission. The State Department of Health also has certain water pollution functions relating to public health and sources of water supply for domestic use.

The Water Pollution Control Commission is composed of the Secretary and Executive Officer of the State Board of Health; the Commissioner of Conservation; the Commissioner of Agriculture, Dairy and Food; the Secretary and Executive Officer of the State Livestock Sanitary Board; and three members-at-large who represent municipal government, industry, and the general public.

The Commission is given the power and duty to make such administrative classifications of the waters of the State as it may deem advisable and establish reasonable pollution standards of the waters of the State in relation to the public use to which they are or may be put. Also, the Commission has the power and duty to approve plans for disposal systems; to issue, continue in effect, or deny permits for the discharge of wastes or for the installation or operation of disposal systems or parts thereof; and to revoke or modify any permit, when necessary, to prevent or abate pollution of any waters of the State. The Commission is authorized to hold hearings and issue orders, if necessary, to prevent pollution. Although the Commission is a separate and distinct entity, all investigations and other staff functions are performed by the State Department of Health.

In Wisconsin, the primary responsibility for the water pollution control program has been vested in the Committee on Water Pollution. The State Board of Health also has comprehensive water pollution control functions. The 1927 Wisconsin State Legislature created the Committee on Water Pollution and designated its powers and duties. This legislation was called the State Water Pollution Control Act and was last revised in 1949.

The Committee on Water Pollution consists of the State Chief Engineer, and a member or other representative of the Public Service Commission designated by the Commission; a Conservation Commissioner or an employee designated by the Conservation Commission; the State Health Officer or a member of the Board of Health designated by the Board; and the State Sanitary Engineer or other engineer appointed by the State Board of Health.

The Committee on Water Pollution is given the power and duty to exercise general supervision over the administration and enforcement of all laws relating to the pollution of the surface waters of the State. The Committee is authorized to issue general orders and adopt rules and regulations applicable throughout the State, and to issue special orders directing particular owners to secure stated operating results toward control of pollution of surface waters within a specified time and can obtain enforcement of its orders through court action. The Committee also has the authority to make studies and investigations, as well as conduct scientific experiments and research, and may enter into agreements with other States and with the Federal Government.

The Minnesota Water Pollution Control Commission and the Wisconsin Committee on Water Pollution agreed in August 1953 to a specific program for the Mississippi River. The joint resolution is as follows:

"WHEREAS, the Mississippi River is an interstate stream bounding the States of Minnesota and Wisconsin and pollution thereof originating in one state may adversely affect public health and public rights in the adjoining state, thus creating problems of common interest and requiring correction by said states;

"WHEREAS, sewage and industrial wastes now discharged into the river and its tributaries does or is likely to create a nuisance or render such waters harmful or detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate uses, or to livestock, wild animals, birds, fish, or other aquatic life; and

"WHEREAS, protection of public health and preservation of public rights demand that said waters shall be made suitable for all normal legitimate uses; now, therefore, be it

"RESOLVED, that the Minnesota Water Pollution Control Commission and Wisconsin Committee on Water Pollution, each does hereby agree to require the correction of existing and prevention of additional pollution within the boundaries of its state to the end that said waters may be maintained or rendered suitable for all purposes heretofore defined and that in the attaining of these objectives the guiding policy shall be the requirement that facilities for treatment of sewage and for industrial wastes shall provide at least effective sedimentation or equivalent, substantially complete removal of floating solids or liquids, and reduction of toxic materials to less than lethal limits for aquatic life, with the understanding that additional or special type treatment be required in those areas where water uses so dictate; and be it further

"RESOLVED, that adoption of this resolution by the water pollution control agency of each state shall be evidenced by the signature of its executive officer."

The water pollution control agencies of Illinois, Iowa, and Wisconsin adopted a joint resolution at Davenport, Iowa, on March 7, 1952, as follows:

"WHEREAS, the Mississippi River is an interstate stream bounding the States of Illinois, Iowa, and Wisconsin and pollution thereof originating in one state does or may adversely affect public health and public rights in adjoining states, thus creating problems of common interest and requiring correction by said states;

"WHEREAS, sewage and industrial wastes now discharged into the river and its tributaries does or is likely to create a nuisance or render such waters harmful or detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate uses, or to livestock, wild animals, birds, fish, or other aquatic life; and

"WHEREAS, protection of public health and preservation of public rights demand that said waters shall be made suitable for all normal legitimate uses; now, therefore, be it

"RESOLVED, that the Illinois Sanitary Water Board, Iowa State Department of Health, and Wisconsin Committee on Water Pollution, each does hereby agree to require the correction of existing and prevention of additional pollution within the boundaries of its state to the end that said waters may be maintained or rendered suitable for all purposes heretofore defined and that in the attaining of these objectives the guiding policy shall be the requirement that facilities for treatment of sewage and for industrial wastes shall provide at least effective sedimentation or equivalent, substantially complete removal of floating solids, or liquids, and reduction of toxic materials to less than lethal limits for aquatic life, with the understanding that additional or special type treatment be required in those areas where water uses so dictate; and be it further

"RESOLVED, that adoption of this resolution by the water pollution control agency of each state shall be evidenced by the signature of its executive officer."

The Minnesota Water Pollution Control Commission and the Minnesota State Board of Health held two joint hearings to discuss present and future sewage and waste disposal problems of the city of Minneapolis and the suburban areas to the north and west which lie in the same drainage area. These meetings were attended by officials of the municipalities concerned and the Minneapolis-St. Paul Sanitary District, and resulted in a decision to form a committee composed of representatives of each municipality to investigate further and determine a possible solution of the sewage disposal problems of the area.

The Wisconsin Committee on Water Pollution and the Wisconsin State Board of Health have conducted water pollution surveys on all the basin streams within Wisconsin. On the basis of information secured during these surveys, hearings have been held and, when necessary, orders were issued to the municipalities and industries which were found to be discharging wastes that had an adverse affect on the waters of the basin.

Formal orders to municipalities and industries for abatement of pollution have not been widely used as an administrative procedure in Iowa and Minnesota. Instead, the water pollution control agencies in these States have preferred to obtain correction by working closely with those producing the wastes in an attempt to avoid using police powers.

This approach has, in general, been successful and formal orders have been used by these States only in those cases where such an approach has not produced abatement of pollution.

The States of the basin also have a uniform policy of not issuing permits for the construction of new sewer systems or extensions of existing ones unless the community requesting the permit has constructed adequate sewage treatment facilities, or is actively planning such construction.

POLLUTION PREVENTION MEASURES REQUIRED

To obtain the maximum utilization of the water resources of the Lower Portion Upper Mississippi River Basin, sewage and industrial wastes discharged to the streams and lakes must be treated to insure that water of suitable quality is available for all water uses. In view of the importance of industry and recreation to the economy of the region, the surface waters available for these uses should be maintained at a quality level that will stimulate the greatest development of these uses.

Water quality objectives pertinent to this basin have been discussed in the section of this report entitled "Uses of Water Resources." The type and design of each individual sewage or waste treatment plant depends upon several variable factors that can be determined only after an engineering survey of local conditions. The exact amount and type of wastes discharged are not known for some of the smaller problems in the basin, but preliminary studies and estimations are sufficient to set forth the abatement needs, and a local engineering survey will determine the exact type and degree of treatment needed. To insure that treatment facilities will satisfactorily protect the water uses and to safeguard the taxpayers' investment, the State water pollution control agencies review plans before construction is undertaken.

The degree of treatment required is influenced by the amount of dilution water available during periods of critical low flow and the water uses to be protected. Two separate and distinct critical stream flow periods occur in this region; the first during the fall, and the second during the winter. Rising water temperatures reduce the capacity of the water to absorb and hold oxygen during low-flow periods which occur in hot weather, while at the same time, the high temperatures accelerate the rate of biological activity with a corresponding increase in the amount of oxygen required. During the winter low-flow period, heavy and prolonged ice cover precludes or diminishes reaeration of the water, and biological activities, while progressing at a slower rate than in warm weather, must be wholly supported by oxygen contained in the receiving waters prior to the discharge of pollution. Thus, where the quantity of waste discharge is large, as in areas where industry is concentrated or where large cities are located, undesirable water conditions are accentuated during low-flow periods. At those points where stream flows may become critical, a high degree of treatment is essential to keep residual pollution loading within the stream's capacity for assimilation during such critical periods.

A number of studies, surveys, and investigations have been conducted by Iowa, Minnesota, and Wisconsin during recent years and these have provided a sound foundation of facts upon which the pollution abatement program has been based. The collected data have permitted a critical evaluation of the effect of pollution upon the receiving waters and have enabled the States to institute proceedings which will secure protection for water resources of the basin. Construction of the needed facilities at an early date will restore, preserve, and protect existing water uses and those uses which may materialize in the immediate foreseeable future. These control measures were determined only after a thorough consideration of all water uses and are considered to be reasonable and adequate. The corrective measures are intended to be flexible and to reflect the needs of the existing situation; however, changes in stream characteristics, pollution load, or water uses may require revisions in the indicated treatment needs at some future date.

Considerable progress has been made in providing municipal and industrial waste treatment facilities, but additional plant construction, replacement and expansion are still needed before all waters of the basin are adequately protected from the effects of municipal and industrial pollution. There is also a need for improved operation at some of the existing treatment plants as failure to operate these waste treatment works at, or near, maximum efficiency means that clean streams for which funds were spent are not obtained.

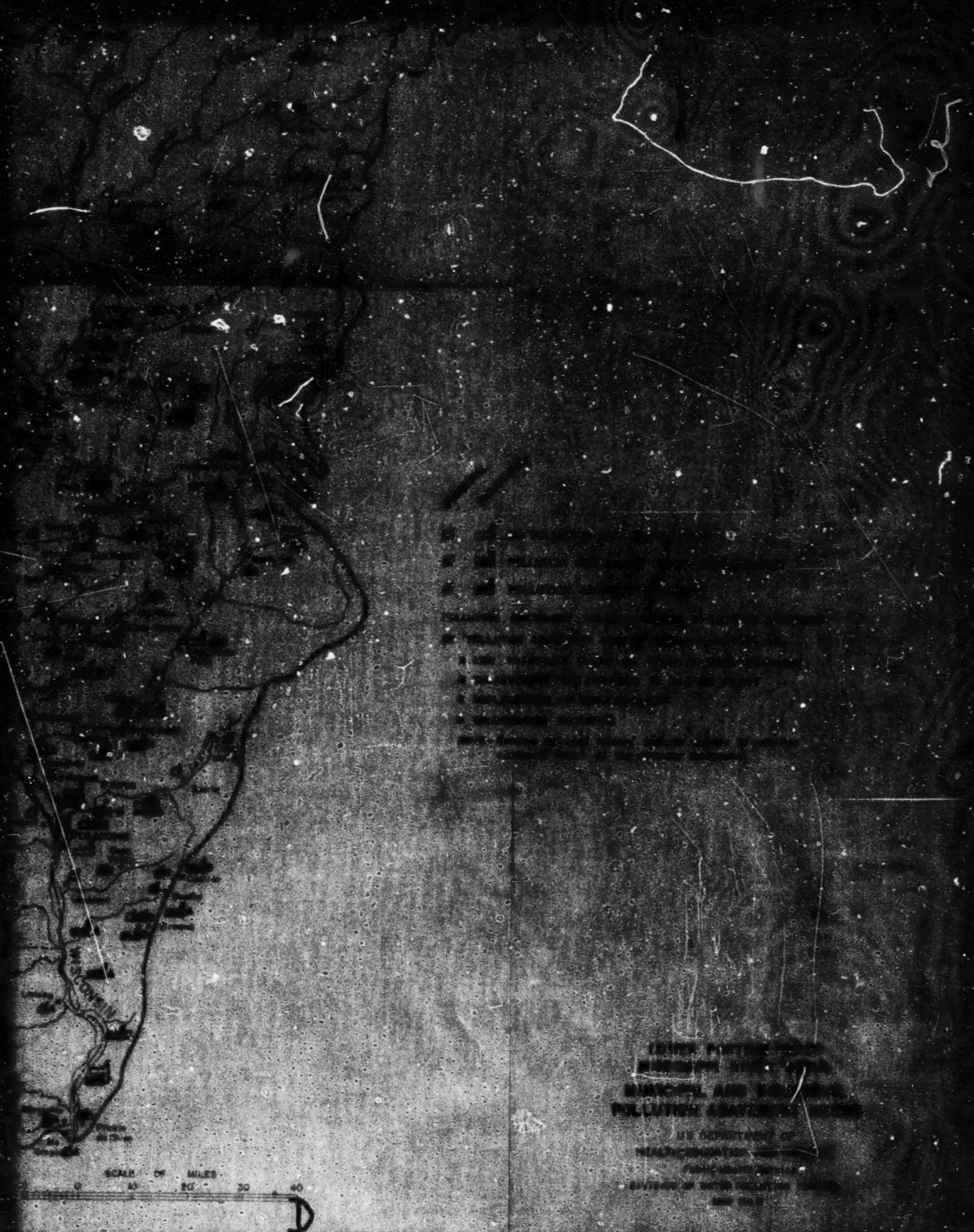
Pollution prevention measures required to control and abate the damaging effects of pollution in the streams of the basin are described herein. Pollution control programs should be dynamic and flexible as they must change to meet changing conditions. However, the population in most of this basin, with the exception of the larger cities, has been relatively stable for the past 20 years, so it is reasonable to expect that when the presently needed facilities are completed the streams of the basin can be kept in good condition as long as the treatment facilities are maintained and operated properly.

Twenty-six municipalities and institutions which are now discharging untreated sewage to the basin's watercourses need new sewage treatment plants to serve their combined sewered population

MINNESOTA
IOWA

MINNESOTA
IOWA

C
WISCONSIN


WISCONSIN
SCALE OF MILES
0
10
20
30
40
D

LOWER [illegible]
[illegible]
MUNICIPAL AND INDUSTRIAL
POLLUTION [illegible]
U S DEPARTMENT OF
[illegible]
[illegible]
[illegible]
[illegible]

of 57,160. One institution, also discharging untreated sewage, can eliminate such discharge by connecting to an existing city sewerage system. Nine existing sewage treatment plants should be replaced by new plants as they can no longer provide adequate treatment, nor can they be economically repaired or enlarged to meet present pollution control requirements.

Enlargements or additions are needed at 33 plants to enable them to produce the type of effluent required by present water uses. Six plants can produce satisfactory treatment if chlorine facilities are provided to sterilize their effluent before discharge, while eight plants are grossly overloaded by storm water which should be removed from the sanitary sewers.

One new plant, one replacement, and one of the enlargements are under construction. Plans have been approved for ten of the new plants, four of the replacements, three of the plants needing enlargements or additions, and one needing chlorine facilities. Twenty other communities which have needs are actively planning the required improvements.

TABLE G
REQUIREMENTS FOR MUNICIPAL AND INDUSTRIAL WASTE TREATMENT PLANTS

Requirements	Municipal: Number of Plants	Municipal: Population Served by Facilities	Industrial Plants Needed
New plant	26	57,160	66*
New plant and sewer system	2	none	0
Enlargement or addition to existing plant	33	85,975	33
Replace plant	9	9,525	2
Chlorination facilities	6	5,100	0
Connect to existing municipal sewers	1	300	4**
Removal of storm water from sanitary sewers	8***	20,670	0
No project required	63	958,640	36
Undetermined	1	1,200	1

*Includes two pulp and paper mills that need new treatment facilities for sanitary sewage.

**All four industries can either connect to municipal sewers or install waste treatment facilities at their industrial plant.

***Includes three municipalities with a combined population served of 5,000; two of which are also listed as needing additions or enlargements, and one listed as needing chlorination facilities.

Sixty-six of the industries need to provide waste treatment facilities for discharges not now being treated, and two need to replace their existing facilities. The addition of facilities or the enlargement of existing plants will provide necessary increased capacity for 33 industries that now treat their wastes.

The pollution abatement program is moving ahead in this basin with three sewage treatment plants and two industrial waste treatment plants under construction, and final construction plans approved by the pollution control agencies for 24 others. Twenty municipalities and 33 industries are actively engaged in preparing plans for the facilities that are needed to abate the pollution caused by their wastes.

TABLE H
STATUS OF TREATMENT WORKS PROJECTS TO ABATE POLLUTION
November 1, 1954

Status of Project	Number Municipal	Number Industrial
No formal action	30	0
Plans under preparation	20	33
Final plans approved	19	5
Under construction	3	2
Status undetermined	10	61

Intensification of State water pollution control educational programs is important to long-range planning and good administration. The undesirable effects of pollution on public health and water conservation must be presented to the public if its support of water pollution control measures is to be expected. Responsible officials of both municipalities and industries should become acquainted with expected treatment needs so that the needed improvements can be planned for well ahead of the time when these needs become an actuality and before damage to the waters has occurred.

APPENDIX

APPENDIX I
BASIC DATA ON SOURCES OF MUNICIPAL* POLLUTION
LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

Name and Location	Population Served by Sewers	P.E. (B.O.D.) Untr'd. Wastes**	Waste Treatment Provided	Adequacy of Treatment Provided		P.E. (B.O.D.) Disch'd. to Watercourse	Treatment Needs	Current Status of Municipal Action
				Cap'y.	Opr.			
MISSISSIPPI RIVER								
Minneapolis-St. Paul Sanitary District***	800,000		Primary with Chem. flocculation	Sat.	Sat.	750,000	None	
So. St. Paul, Minn.	10,000		Secondary	Unsat.	Sat.	575,000	Enlargement	Inactive
St. Paul Park, Minn.	2,160		None				New plant	Under constr.
Hastings, Minn.	5,000		None				New plant	Act. planning
Hastings St. Asylum	1,240		Secondary	Sat.	Sat.		None	
Red Wing, Minn.	9,000		None				New plant	Inactive
State School for Boys	350		None				New plant	Inactive
Lake City, Minn.	3,000		Primary	Sat.	Unsat.		None	
Pepin, Wis.	750		Primary	Sat.	Sat.		None	
Wabasha, Minn.	2,300		Primary	Sat.	Sat.		None	
Alma, Wis.	900		Primary	Unsat.	Unsat.	530	Chlorine facilities	Act. planning
Fountain City, Wis.	900		None			2,750	New plant	Plans approved
Winona, Minn.	22,000		Primary	Sat.	Sat.		None	
La Crescent, Minn.	700		Secondary	Sat.	Sat.		None	
LaCrosse, Wis.	45,000		Primary	Sat.	Sat.	27,985	None	
Holy Cross Seminary	Undet.		Primary	Sat.	Unsat.		Chlorine facilities	Undet.

Viroqua, Wis. Vernon Co. Institutions	3,795 Undet.		Secondary Secondary	Unsat. Sat.	Sat. Sat.		Additions None	Undet.
Lansing, Ia.	1,100		None			1,100	New plant	Inactive
Marquette, Ia.	600		None			600	New plant	Act. planning
Prairie du Chien, Wis.	4,000		None			14,500	New plant	Act. planning
McGregor, Ia.	1,000		None			1,000	New plant	Inactive
BASSETT CREEK								
Mnpls. Work House, Minn.	300		Secondary	Sat.	Sat.		None	
MINNEHAHA CREEK								
Excelsior, Minn.	1,300		Secondary	Sat.	Sat.		None	
Wayzata, Minn.	1,300		Secondary	Unsat.	Unsat.		Enlargement	Under const.
PHALEN CREEK								
White Bear Lake, Minn.	2,500		Secondary	Sat.	Sat.		None	
VERMILION RIVER								
Lakeville, Minn.	490		Secondary	Unsat.	Unsat.		Additions	Inactive
Farmington, Minn.	1,000		Primary	Unsat.	Unsat.		Replace plant	Plans approved
Rosemount, Minn. U of Minn. Res. Center	50		Primary	Sat.	Sat.		None	
CANNON RIVER								
Northfield, Minn.	4,100		None				New plant	Plans approved
Cannon Falls, Minn.	1,400		None				New plant	Plans approved
Mineral Springs San.	100		Primary	Unsat.	Unsat.		Enlargement	Act. planning
STRAIGHT RIVER								
Owatonna, Minn.	9,000		Secondary	Unsat.	Sat.	1,200	Enlargement	Act. planning
Faribault, Minn. Walcott Farm-Sch. & Col.	13,000 2,925		None Primary	 Unsat.	 Unsat.		New plant Replace plant	Plans approved Act. planning

See footnotes at end of table.

APPENDIX I (Contd.)

Name and Location	Population Served by Sewers	P.E. (B.O.D.) Untr'd. Wastes**	Waste Treatment Provided	Adequacy of Treatment Provided		P.E. (B.O.D.) Disch'd. to Watercourse	Treatment Needs	Current Status of Municipal Action
				Cap'y.	Opr.			
ISABELLE CREEK								
Ellsworth, Wis., E. Plant	650		Secondary	Unsat.	Sat.		Replace plant)	Act. Planning
N. Plant	100		Primary	Unsat.	Sat.		Replace plant)	
W. Plant	350		Primary	Unsat.	Sat.		Replace plant)	
RUSH RIVER								
Baldwin, Wis.	500	8,688	Secondary	Unsat.	Sat.	2,040	Enlargement	Inactive
Hammond, Wis.	470		Secondary	Sat.	Sat.		None	
CHIPPEWA RIVER								
Bruce, Wis.	800		Primary	Unsat.	Sat.	340	Chlorine facilities	Plans approved
Weyerhauser, Wis.	Undet.		Primary	Sat.	Sat.		None	
Holcombe, Wis.	None						Sewers and treat. plant	Act. planning
Cornell, Wis.	1,700	7,370	Primary	Sat.	Sat.		None	
Jim Falls, Wis. Northern States Power Co.	Undet.		Septic tank & soil abs.	Sat.	Sat.		None	
Chippewa Falls, Wis.	10,370	28,335	Secondary	Sat.	Unsat.		Removal of storm water from san. sewer	Undet.
Chippewa County Hosp.	400		Primary	Sat.	Sat.		None	
Northern Col. & Tr. Sch.	Undet.		Primary	Sat.	Sat.	2,320	Removal of storm water from san. sewer	Inactive
Eau Claire, Wis.	31,240	130,260	Primary	Unsat.	Sat.	40,000	Enlargement	Plans approved

Durand, Wis.	1,400		None				New plant	Plans approved
Plum City, Wis.	300		Primary	Unsat.	Unsat.		Additions	Inactive
FLAMBEAU RIVER								
Park Falls, Wis.	2,800	1,870	Secondary	Sat.	Sat.	300	None	
Ladysmith, Wis.	3,100	4,200	Secondary	Sat.	Sat.	1,085	Removal of storm water from san. sew.	Inactive
BUTTERNUT CREEK								
Butternut, Wis.	500		Primary	Unsat.	Sat.	2,090	Add. & removal of storm water from san. sew.	Act. planning
ELK RIVER								
Phillips, Wis.	1,600		Primary	Unsat.	Sat.	820	Additions	Plans approved
JUMP RIVER								
Prentice, Wis.	450		Secondary	Sat.	Unsat.	25	None	
Hawkins, Wis.	300		Primary	Unsat.	Unsat.		Additions	Inactive
YELLOW RIVER (of Chippewa)								
Gilman, Wis.	None						Sewers & treat. plant	Act. planning
Cadott, Wis.	600		Primary	Unsat.	Sat.	1,190	Removal of storm water from san. sew.	Inactive
DUNCAN CREEK								
Bloomer, Wis.	2,200	3,800	Secondary	Sat.	Sat.	455	None	
EAU CLAIRE RIVER								
Thorp, Wis.	900	5,400	Secondary	Unsat.	Sat.	700	Additions	Undet.
Stanley, Wis.	1,600		Secondary	Unsat.	Sat.		Removal of storm water from san. sew.	Inactive

See footnotes at end of table.

APPENDIX I (Contd.)

Name and Location	Population Served by Sewers	P.E. (B.O.D.) Untr'd. Wastes**	Waste Treatment Provided	Adequacy of Treatment Provided		P.E. (B.O.D.) Disch'd. to Watercourse	Treatment Needs	Current Status of Municipal Action
				Cap'y.	Opr.			
EAU CLAIRE RIVER (Contd.)								
Boyd, Wis.	500		Secondary	Unsat.	Unsat.	120	Chlorine facilities	Inactive
Augusta, Wis.	1,200		Secondary	Sat.	Unsat.		None	
Fall Creek, Wis.	350		Secondary	Sat.	Sat.	450	None	
Altoona, Wis.	1,000		Primary	Sat.	Sat.		None	
RED CEDAR RIVER								
Rice Lake, Wis.	5,200		Secondary	Sat.	Sat.		None	
Cameron, Wis.	Undet.		Secondary	Sat.	Sat.		None	
Barron, Wis,	2,060		Secondary	Sat.	Sat.		None	
Chetek, Wis.	2,000		Primary	Unsat.	Unsat.	1,450	Enlargement & removal of storm weter from san. sew.	Act. planning
Colfax, Wis.	800		Secondary	Sat.	Sat.		None	
Menomonie, Wis. (North pt.)	200		Secondary	Sat.	Unsat.	180	None	
(Other pt.)	6,600		Primary	Unsat.	Unsat.	8,100	Additions	Inactive
HAY RIVER								
Cumberland, Wis.	1,200		Secondary	Sat.	Sat.		None	
Turtle Lake, Wis.	620		Secondary	Sat.	Sat.	90	None	
Glenwood, Wis.	700	2,755	Secondary	Unsat.	Unsat.	1,320	Enlargement	Act. planning

EAU GALLE RIVER								
Spring Valley, Wis.	975		Secondary	Sat.	Unsat.	690	None	
Elmwood, Wis.	450	3,000	Secondary	Unsat.	Sat.	1,680	Enlargement	Undet.
BUFFALO RIVER								
Osseo, Wis.	900	570	Primary	Unsat.	Sat.	545	Enlargement	Inactive
Strum, Wis.	Undet.		Secondary	Sat.	Sat.		None	
Eleva, Wis.	400	520	Primary	Sat.	Unsat.	260	Chlorination of effluent	Inactive
Mondovi, Wis.	1,500	3,220	Secondary	Sat.	Sat.		None	
ZUMBO RIVER								
Rochester, Minn.	25,000		Secondary	Sat.	Sat.		None	
ZUMBO RIVER (S. Middle Br.)								
Claremont, Minn.	420		Primary	Unsat.	Unsat.		Enlargement	Inactive
Dodge Center, Minn.	900		Primary	Unsat.	Unsat.		Enlargement	Inactive
Kasson, Minn.	1,100		Secondary	Sat.	Unsat.		None	
ZUMBO RIVER (N. Middle Br.)								
W. Concord, Minn.	650		Secondary	Sat.	Unsat.		None	
Pine Island, Minn.	900		None				New plant	Act. planning
ZUMBO RIVER (N. Br.)								
Kenyon, Minn.	1,400		Secondary	Sat.	Sat.		None	
Wanamingo, Minn.	430		None				New plant	Inactive
Zumbrota, Minn.	1,300		None				New plant	Inactive
Mazeppa, Minn.	500		None				New plant	Inactive
Goodhue, Minn.	460		Secondary	Sat.	Sat.		None	
WHITEWATER RIVER								
Plainview, Minn.	1,400		Secondary	Sat.	Sat.		None	
St. Charles, Minn.	1,400		Primary	Unsat.	Unsat.		Replace plant	Plans approved
Altura, Minn.	240		Secondary	Sat.	Sat.		None	

See footnotes at end of table.

APPENDIX I (Contd.)

Name and Location	Population Served by Sewers	P.E. (B.O.D.) Untr'd. Wastes**	Waste Treatment Provided	Adequacy of Treatment Provided		P.E. (B.O.D.) Disch'd. to Watercourse	Treatment Needs	Current Status of Municipal Action
				Cap'y.	Opr.			
TREMPEALEAU RIVER								
Merrillan, Wis.	500		None				New plant	Plans approved
Alma Center, Wis.	400		Secondary	Sat.	Sat.		None	
Taylor, Wis.	400		Primary	Sat.	Sat.		None	
Blair, Wis.	850		None				New plant	Plans approved
Whitehall, Wis.	700	3,980	None			3,980	New plant	Plans approved
Independence, Wis.)	100		Primary	Unsat.	Unsat.		Replace plant	Plans approved for one plant for city
)	800		None				New plant	
Arcadia, Wis.	1,200	720	None			720	New plant	Plans approved
BLACK RIVER								
Medford, Wis.	2,000		Secondary	Sat.	Sat.		None	
Greenwood, Wis. (North pt.)	350	350	Primary	Unsat.	Unsat.	220	Additions	Inactive
(South pt.)	350	1,100	Primary	Unsat.	Unsat.	1,020	Additions	Inactive
Loyal, Wis.	750	270	Primary	Unsat.	Sat.	220	Additions	Act. planning
Granton, Wis.	Undet.		Primary	Unsat.	Sat.	70	Additions	Inactive
Neillsville, Wis.	2,500		None				New plant	Act. planning
Black River Falls, Wis.	2,500		Primary	Unsat.	Sat.	1,840	Chlorine facilities & removal of storm water from san. sew.	Inactive
Melrose, Wis.	250	350	Secondary	Sat.	Sat.	40	None	
POPLAR RIVER								
Dorchester, Wis.	450		Secondary	Sat.	Sat.	70	None	
Owen, Wis.	900		Secondary	Sat.	Sat.		None	
BEAVER CREEK								
Ettrick, Wis.	400		Primary	Sat.	Sat.		None	
Galesville, Wis.	1,800	5,700	Secondary	Sat.	Sat.		None	

HALF WAY CREEK								
Holmen, Wis.	480		Secondary	Sat.	Sat.		None	
LACROSSE RIVER								
Cashton, Wis.	600		Secondary	Unsat.	Sat.	325	Enlargement	Act. planning
Camp McCoy, Wis.	Undet.	54,000	Secondary	Sat.	Sat.	1,700	None	
Sparta, Wis.	5,820	7,900	Secondary	Sat.	Sat	1,300	None	
Bangor, Wis.	700	1,730	Primary	Unsat.	Sat.	1,255	Additions	Inactive
West Salem, Wis.	1,500	1,475	None			1,475	New plant	Act. planning
LaCrosse Co. Asylum	300		None				Connect to city	Undet.
ROOT RIVER								
Stewartville, Minn.	970		Secondary	Sat.	Unsat.		None	
Grand Meadow, Minn.	600		Secondary	Unsat.	Unsat.		Enlargement	Plans approved
Spring Valley, Minn.	1,900		Secondary	Sat.	Unsat.		None	
Chatfield, Minn.	1,200		Secondary	Sat.	Sat.		None	
Preston, Minn.	1,300		None				New plant	Plans approved
Lanesboro, Minn.	1,000		Secondary	Sat.	Unsat.		None	
Rushford, Minn.****	2,135		Secondary	Sat.	Unsat.		None	
Lewiston, Minn.	700		Secondary	Sat.	Unsat.		None	
Houston, Minn.	850		Primary	Unsat.	Sat.		Enlargement	Inactive
ROOT RIVER (S. Fork)								
Harmony, Minn.	500		Primary	Unsat.	Unsat.		Replace plant	Under constr.
Mabel, Minn.	650		Secondary	Sat.	Unsat.		None	
COON CREEK								
Westby, Wis.	1,200		Secondary	Sat.	Sat.		Undet.	
Coon Valley, Wis.	350		Secondary	Unsat.	Sat.		Additions	Undet.
Stoddard, Wis.	370		Secondary	Sat.	Sat.		None	
CROOKED CREEK								
Caledonia, Minn.	1,700		Secondary	Sat.	Sat.		None	
UPPER IOWA RIVER								
Le Roy, Minn.	670		None				New plant	Undet.
Lime Springs, Ia.	500		Secondary	Sat.	Sat.	100	None	

See footnotes at end of table.

APPENDIX I (Contd.)

Name and Location	Population Served by Sewers	P.E. (B.O.D.) Untr'd. Wastes**	Waste Treatment Provided	Adequacy of Treatment Provided		P.E. (B.O.D.) Disch'd. to Watercourse	Treatment Needs	Current Status of Municipal Action
				Cap'y.	Opr.			
UPPER IOWA RIVER (Contd.)								
Cresco, Ia.	3,000	3,000	Secondary	Unsat.	Sat.	700	Enlargement	Plans approved
Decorah, Ia.	5,000	6,000	Secondary	Unsat.	Sat.	1,500	Enlargement	Undet.
Spring Grove, Minn.	880		Primary	Unsat.	Sat.		Enlargement	Undet.
PAINT CREEK								
Waukon, Ia.	2,500	3,000	Secondary	Unsat.	Sat.	1,000	Replace plant	Inactive
YELLOW RIVER								
Postville, Ia.	1,100	1,430	Secondary	Sat.	Sat.	215	None	
Monona, Ia. (N. plant)	550	550	Secondary	Unsat.	Unsat.	100	Additions	Inactive

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

**Includes industrial wastes discharged into municipal sewerage systems.

***Minneapolis-St. Paul Sanitary District serves Minneapolis, St. Paul, Columbia Hts., Edina, Fort Snelling, Fridley, Hopkins, Lauderdale, Minn. Soldiers Home, Morningside, New Brighton, Ramsey Pavilion, Richfield, Robbinsdale, St. Anthony, St. Louis Park, State Hospital for Crippled Children, W. St. Paul, and N. St. Paul.

****Also serves Rushford Village, Minn.

APPENDIX II

BASIC DATA ON SOURCES OF INDUSTRIAL* POLLUTION

LOWER PORTION UPPER MISSISSIPPI RIVER BASIN

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				Cap'y.	Opr.			
MISSISSIPPI RIVER								
St. Paul Park, Minn.								
Northwestern Refining Co.	Petroleum	Org & Inorg	Primary	Sat.	Sat.		None	
Maiden Rock, Wis.								
Ellsworth Coop. Cry.	Food	Organic	None			180	New plant	Undet.
Cochrane, Wis.								
Garden Valley Coop. Cry.	Food	Organic	None			295	New plant	Undet.
Fountain City, Wis.								
Fountain City Brewing Co.	Food	Organic	None			924	New plant or connect to city sewer	Plans approved
Fountain City Coop. Cry.	Food	Organic	None			340	New plant or connect to city sewer	Plans approved
Winona, Minn.								
Swift & Co.	Food	Organic	None				New plant	Under constr.
Trempealeau, Wis.								
Centerville Coop. Cry.	Food	Organic	None			230	New plant	Act. planning
Viroqua, Wis.								
Viroqua Coop. Cry.	Food	Organic	Secondary	Unsat.	Sat.		Enlargement	Undet.
DeSoto, Wis.								
DeSoto Cry.	Food	Organic	None				New plant	Undet.
Ferryville, Wis.								
Ferryville Cheese Fct.	Food	Organic	Primary	Unsat.	Sat.		Additions	Undet.

*Industries having separate outlets and discharging wastes directly to watercourse.

APPENDIX II (Contd.)

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				Cap'y.	Opr.			
MISSISSIPPI RIVER (Contd.)								
Genoa, Wis. Genoa Coop. Cry.	Food	Organic	None				New plant	Undet.
Prairie du Chien, Wis. Nat'l Decorating Metal Co.	Fab. Metal	Inorganic	None				New plant	Undet.
Wis. Farmco Service Coop.	Chemical	Inorganic	Primary	Sat.	Sat.		None	
MINNEHAHA CREEK								
Orono Twp., Minn. Mather Cheese Co.	Food	Organic	None				New plant	Undet.
VERMILION RIVER								
Vermilion, Minn. Empire Rendering Co.	Food	Organic	Secondary	Sat.	Sat.		None	
STRAIGHT RIVER								
Owatoona, Minn. Owatoona Canning Co.	Food	Organic	Secondary	Unsat.	Unsat.		Enlargement	Act. planning
Faribault, Minn. Faribault Cannery	Food	Organic	None				New plant	Plans approved
ISABELLE CREEK								
Ellsworth, Wis. Ellsworth Coop. Cry.	Food	Organic	Primary	Unsat.	Sat.	2,600	Enlargement	Act. planning
CHIPPEWA RIVER								
Bruce, Wis. Abbotts Dairies, Inc.	Food	Organic	Primary	Sat.	Sat.		None	

Conrath, Wis.								
Conrath Coop. Dairy Co.	Food	Organic	Primary	Unsat.	Unsat.	310	Enlargement	Act. planning
Holcombe, Wis.								
Holcombe Dairy	Food	Organic	None			325	New plant	Undet.
Cornell, Wis.								
Cornell Paperboard Prods.	Paper	Org & Inorg	Minor	Unsat.	Sat.	5,617	Additions	Act. planning
Jim Falls, Wis.								
Falls Dairy Co.	Food	Organic	Primary	Unsat.	Sat.	2,030	Additions	Undet.
Chippewa Falls, Wis.								
Peter Fox & Sons	Food	Organic	Primary	Sat.	Sat.		None	
Lafayette Creamery	Food	Organic	None			180	New plant	Act. planning
Leinenkugel Brewery	Food	Organic	Secondary	Sat.	Sat.		None	
A. F. Schwann & Sons	Food	Organic	Primary	Sat.	Sat.		None	
Tilden Creamery Co.	Food	Organic	Primary	Unsat.	Unsat.	450	Additions	Undet.
Eau Claire, Wis.								
Eau Claire Sand & Gravel Co.	Quarry	Inorganic	None				New plant	Undet.
Gibson Dairy	Food	Organic	Primary	Unsat.	Unsat.	30	Additions	Undet.
Silver Spr. Gardens Inc.	Food	Organic	Secondary irrigation	Sat.	Sat.		None	
Sterling Pulp & Paper Co. (paper pt.)	Paper	Org & Inorg	Primary	Sat.	Sat.)		None	
(pulp pt.)		Org & Inorg	Hauling part to roads	Unsat.	Unsat.)	181,200	Waste reduc.	Act. planning
(san. sew.)		San. sew.	None				New plant or connect to city	Undet.
U. S. Rubber Co.	Rubber	Organic	None				New plant	Act. plan.
Wissota Sand & Gravel Co.	Quarry	Inorganic	None				New plant	Undet.
Durand, Wis.								
Durand Canning Co.	Food	Organic	None				New plant	Undet.
Lakeside Butter Co.	Food	Organic	None				New plant	Undet.
Tarrant Coop. Cry.	Food	Organic	None			85	New plant	Undet.
Arkansaw, Wis.								
Rochester Dairy Coop.	Food	Organic	None			700	New plant	Undet.

APPENDIX II (Contd.)

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				Cap'y.	Opr.			
FLAMBEAU RIVER								
Park Falls, Wis.								
Flambeau Paper Co.								
(paper pt)	Paper	Org & Inorg	Primary	Sat.	Sat.	1,920	None	
(pulp pt.)		Org & Inorg	Primary**	Unsat.	Unsat.	274,800	Enlargement	Act. plan.
Fifield, Wis.								
Ladysmith Milk Prod. Coop.	Food	Organic	None			160	New plant	Undet.
Ladysmith, Wis.								
Grow Coop. Cry. Assn.	Food	Organic	None			1,690	New plant	Undet.
Peavy Paper Mills	Paper	Org & Inorg	Primary	Unsat.	Unsat.	1,200	Waste reduc.	Undet.
		San. Sew.	None				New plant or connect to city	Undet.
BUTTERNUT CREEK								
Butternut, Wis.								
Northern Hardwood Veneers	Lumber	Organic	None				New plant	Undet.
JUMP RIVER								
Ogema, Wis.								
Ogema Creamery	Food	Organic	Primary	Unsat.	Unsat.	115	Additions	Undet.
Prentice, Wis.								
Ladysmith Milk Prod. Coop.	Food	Organic	Primary	Unsat.	Unsat.	875	Additions	Undet.
Northwest Dry Milk Co.	Food	Organic	Primary	Unsat.	Unsat.		Additions	Undet.
Sheldon, Wis.								
Sheldon Creamery	Food	Organic	None			710	New plant	Act. plan.

Hawkins, Wis. Hawkins Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	850	Additions	Undet.
YELLOW RIVER OF CHIPPEWA								
Gilman, Wis. Drangle Foods, Inc.	Food	Organic	Primary	Unsat.	Unsat.	565	Additions	Undet.
Progressive Cheese Fct.	Food	Organic	None			430	New plant	Undet.
Cadott, Wis. Clear Creek Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	325	Additions	Undet.
Hillside Dairy	Food	Organic	None			1,640	New plant	Act. plan.
Little Drywood Cheese Fct.	Food	Organic	None			360	New plant	Undet.
EAU CLAIRE RIVER								
Fairchild, Wis. Southside Cheese Fct.	Food	Organic	Secondary	Unsat.	Unsat.	240	Enlargement	Act. plan.
Thorp, Wis. Lombard Dairy	Food	Organic	Primary	Unsat.	Unsat.	470	Additions	Act. plan.
Reseburg Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	175	Additions	Undet.
Stanley, Wis. Brownsville Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	600	Additions	Undet.
South Stanley Cheese Fct.	Food	Organic	Secondary	Sat.	Sat.		None	
Boyd, Wis. Maple Hill Coop. Cheese & Butter	Food	Organic	Primary	Unsat.	Unsat.		Additions	Undet.
Augusta, Wis. Augusta Canned Foods	Food	Organic	Secondary	Sat.	Sat.		None	
Dairy Maid Coop.	Food	Organic	None			1,175	New plant	Undet.
Fall Creek, Wis. Luddington Coop. Cry.	Food	Organic	Primary	Unsat.	Unsat.	190	Additions	Act. plan.
Altoona, Wis. C. St. P.M. & O. RR	Misc.	Inorganic	None				New plant	Undet.
RED CEDAR RIVER								
Haugen, Wis. Bear Lake Cheese Fct.	Food	Organic	None			325	New plant	Act. plan.

**Company practices artificial river reaeration during summer months.

APPENDIX II (Contd.)

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				Cap'y.	Opr.			
RED CEDAR RIVER (Contd.)								
Haugen, Wis. (Contd.)								
Wissota Sand & Gravel Co.	Quarry	Inorganic	Primary	Sat.	Sat.		None	
Brill, Wis.								
Brill Coop Cry.	Food	Organic	None			360	New plant	Undet.
Campia, Wis.								
Campia Butter & Cheese Co.	Food	Organic	Primary	Unsat.	Unsat.	130	Additions	Undet.
Rice Lake, Wis.								
Johnson Welding & Mfg. Co.	Fab. Metal	Inorganic	None				New plant	Undet.
Red Cedar River Coop. Cheese Fct.	Food	Organic	None			310	New plant	Undet.
Tuscobia Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	150	Additions	Act. plan.
Sand Creek, Wis.								
Falls Dairy Co.	Food	Organic	Primary	Unsat.	Unsat.	130	Replacement	Undet.
Ridgeland, Wis.								
Foremost Dairies, Inc.	Food	Organic	None				New plant	Undet.
Wilson, Wis.								
Summit Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	810	Additions	Act. plan.
Knapp, Wis.								
Knapp Creamery Co.	Food	Organic	None			685	New plant	Undet.
Menomonie, Wis.								
Parker Pen Co.	Misc.	Inorganic	Secondary	Sat.	Sat.		None	
Teagarden Coop. Cheese Fct.	Food	Organic	None			600	New plant	Act. plan.
Lange Canning Corp.	Food	Organic	Primary	Sat.	Sat.		None	

HAY RIVER								
Cumberland, Wis. Stokely Foods, Inc.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
Prairie Farm, Wis. Pine Grove Cheese Fct.	Food	Organic	None			290	New plant	Act. plan.
Pleasant Creek Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	265	Additions	Act. plan.
Sheridan Cheese Fct.	Food	Organic	None			270	New plant	Undet.
Turtle Lake, Wis. Turtle Lake Coop. Cry.	Food	Organic	None				None***	
Clayton, Wis. Stella Cheese Co.	Food	Organic	Secondary	Unsat.	Unsat.	790	Enlargement	Undet.
Downing, Wis. Armour and Co.	Food	Organic	Primary	Unsat.	Unsat.	865	Additions	Act. plan.
Connorsville Coop. Cry.	Food	Organic	None			220	New plant	Undet.
Boyceville, Wis. Annis Creek Cheese Fct.	Food	Organic	None			215	New plant	Act. plan.
Boyceville Farmers Coop. Cry.	Food	Organic	None			230	New plant	Act. plan.
Graytown, Wis. Graytown, Cheese Fct.	Food	Organic	None			360	New plant	Undet.
EAU GALLE RIVER								
Eau Galle, Wis. Eau Galle Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	810	Additions	Act. plan.
BUFFALO RIVER								
Osseo, Wis. Foster Coop. Cry.	Food	Organic	None			300	New plant	Undet.
Osseo Canning Co.	Food	Organic	Primary	Sat.	Sat.	348	None	
Osseo Coop. Cry. Co.	Food	Organic	None			150	New plant	Act. plan.
United Milk Products Co.	Food	Organic	None			720	New plant	Act. plan.
York Coop. Cry. Assn.	Food	Organic	None			190	New plant	Undet.
Strum, Wis. Unity Coop. Cry.	Food	Organic	None			318	New plant	Undet.

***Discharges waste to a swamp where it is stabilized before it is discharged to creek.

APPENDIX II (Contd.)

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				Cap'y.	Opr.			
BUFFALO RIVER (Contd.)								
Eleva, Wis. Pleasant Valley Coop. Cry.	Food	Organic	None			325	New plant	Act. plan.
Mondovi, Wis. Mondovi Canning Corp.	Food	Organic	Minor	Unsat.	Unsat.	290	New plant	Under const.
Gilmanton, Wis. Gilmanton Coop. Cry.	Food	Organic	None			460	New plant	Undet.
Modena, Wis. Modena Coop. Cry.	Food	Organic	None			230	New plant	Act. plan.
ZUMBRO RIVER (S. Br.)								
Rochester, Minn. Libby, McNeil & Libby	Food	Organic	Primary	Sat.	Sat.		None	
ZUMBRO RIVER (S. Middle Br.)								
Claremont, Minn. Claremont Cry. Assn.	Food	Organic	None				New plant	Plans appr.
Dodge Center, Minn. Anderson Can. & Pickle Co.	Food	Organic	Primary	Sat.	Unsat.		None	
ZUMBRO RIVER (N. Br.)								
Kenyon, Minn. Goodhue Canning Co.	Food	Organic	Primary	Undet.	Undet.		Undet.	
Zumbrota, Minn. Zumbrota By-Prod. Co.	Food	Organic	Secondary	Sat.	Unsat.		None	
WHITEWATER RIVER								
Plainview, Minn. Lakeside Packing Co.	Food	Organic	Secondary	Sat.	Unsat.		None	

TREMPEALEAU RIVER								
Blair, Wis.								
Blair Packing Co.	Food	Organic	Primary	Unsat.	Unsat.	6,480	Replacement	Undet.
Preston Coop. Cry.	Food	Organic	None			1,750	New plant	Act. plan.
Hixton, Wis.								
Northfield Coop. Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.		Additions	Undet.
Pigeon Falls, Wis.								
Pigeon Falls Coop. Cry.	Food	Organic	None				New plant	Undet.
Arcadia, Wis.								
A. G. Coop. Cry.	Food	Organic	None			1,345	New plant	Act. plan.
Dodge, Wis.								
Dodge Creamery	Food	Organic	None			150	New plant	Undet.
BLACK RIVER								
Medford, Wis.								
Medford Coop. Cry.	Food	Organic	Primary	Sat.	Sat.		None	
Medford Fur Foods Co.	Food	Organic	Hauling to land	Sat.	Sat.		None	
Oconomowoc Canning Co.	Food	Organic	Primary	Sat.	Sat.		None	
Greenwood, Wis.								
John Wuethrich Cry. Co.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
Loyal, Wis.								
Loyal Canning Co.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
Pine Grove Cheese Fct.	Food	Organic	None			760	New plant	Act. plan.
Granton, Wis.								
Lynn Dairy	Food	Organic	None			360	New plant	Undet.
South Grant Cheese Fct.	Food	Organic	None			360	New plant	Act. plan.
Humbird, Wis.								
Humbird Canning Co.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
Humbird Cheese Fct.	Food	Organic	Primary	Unsat.	Unsat.	100	Additions	Plans approved
Willard, Wis.								
Gorman Coop. Dairy	Food	Organic	Secondary	Unsat.	Unsat.	145	Enlargement	Act. plan.
Black River Falls, Wis.								
Charter Oak Feed Mill	Food	Organic	Hauling to land	Sat.	Sat.		None	

APPENDIX II (Contd.)

Name and Location	Type of Industry	Type of Waste Produced	Treatment or Other Pollution Control Measures			P.E. (B.O.D.) Disch'd. to Water-course	Pollution Abatement Needs	Current Status of Industrial Needs
			Degree	Adequacy				
				cap'y.	Opr.			
BLACK RIVER (Contd.)								
Melrose, Wis. Lutz Feed Mill	Food	Organic	Hauling to land	Sat.	Sat.		None	
North Bend, Wis. North Bend Coop. Cry.	Food	Organic	None			340	New plant	Act. plan.
Mindoro, Wis. Mindoro Coop. Cry.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
POPLAR RIVER								
Owen, Wis. Owen Canning Co.	Food	Organic	Primary (lagoons)	Sat.	Sat.		None	
HALF-WAY CREEK								
Holmen, Wis. Holmen Canning Co.	Food	Organic	Secondary (irrigation)	Sat.	Sat.		None	
Holmen Coop. Cry. Assn.	Food	Organic	None			690	New plant	Undet.
LA CROSSE RIVER								
Cashton, Wis. Cashton Coop. Cry.	Food	Organic	Secondary	Unsat.	Sat.	2,460	Enlargement	Undet.
La Crosse, Wis. Northern States Power Co.	Gas	Org & Inorg	Primary	Sat.	Unsat.		None	
ROOT RIVER								
Spring Valley, Minn. Spring Valley Rend. Co.	Food	Organic	Primary	Sat.	Unsat.		None	
Chatfield, Minn. Chatfield Rendering Co.	Food	Organic	Primary	Sat.	Sat.		None	

COON CREEK								
Chaseburg, Wis. Chaseburg Coop. Cry.	Food	Organic	None				New plant	Undet.
BAD AXE RIVER								
Westby, Wis. Esofea Cheese Fct.	Food	Organic	None				New plant	Undet.
UPPER IOWA RIVER								
Cresco, Iowa Rendering plant	Food	Organic	Primary	Sat.	Sat.		None	
YELLOW RIVER								
Postville, Iowa Farmers Coop. Cry. Co.	Food	Organic	None			380	New plant	Undet.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1955 O—349881